EDEXCEL CORE MATHEMATICS C1 (6663) – MAY 2017 FINAL MARK SCHEME

Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number

Candidate Number

AS and A level Mathematics

Practice Paper
Pure Mathematics - Algebra (part 1)

You must have:
Mathematical Formulae and Statistical Tables (Pink)

Total Marks

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all the questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 17 questions in this question paper. The total mark for this paper is 80.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.
- Calculators must not be used for questions marked with a * sign.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

1*. Show that $\dfrac{2}{\sqrt{12} - \sqrt{8}}$ can be written in the form $\sqrt{a} + \sqrt{b}$, where a and b are integers.

(Total 5 marks)

2*. (*a*) Simplify

$$\sqrt{50} - \sqrt{18}$$

giving your answer in the form $a\sqrt{2}$, where a is an integer.

(2)

(*b*) Hence, or otherwise, simplify

$$\frac{12\sqrt{3}}{\sqrt{50} - \sqrt{18}}$$

giving your answer in the form $b\sqrt{c}$, where b and c are integers and $b \neq 1$

(3)

(Total 5 marks)

3*. (a) Write down the value of $32^{\frac{1}{5}}$

(1)

(b) Simplify fully $(32x^5)^{-\frac{2}{5}}$

(3)

(Total 4 marks)

4*. (a) Evaluate $81^{\frac{3}{2}}$

(2)

(b) Simplify fully $x^2\left(4x^{-\frac{1}{2}}\right)^2$

(2)

(Total 4 marks)

5*. (a) Find the value of $16^{-\frac{1}{4}}$

(2)

(b) Simplify $x\left(2x^{-\frac{1}{4}}\right)^4$

(2)

(Total 4 marks)

6*. (a) Evaluate $(32)^{\frac{3}{5}}$, giving your answer as an integer.

(2)

(b) Simplify fully $\left(\frac{25x^4}{4}\right)^{-\frac{1}{2}}$

(2)

(Total 4 marks)

7*. (a) Find the value of $8^{\frac{5}{3}}$

(2)

(b) Simplify fully $\frac{(2x^{\frac{1}{2}})^3}{4x^2}$

(3)

(Total 5 marks)

8*. Express 8^{2x+3} in the form 2^y, stating y in terms of x.

(Total 2 marks)

9*. Express 9^{3x+1} in the form 3^y, giving y in the form $ax + b$, where a and b are constants.

(Total 2 marks)

10*. $f(x) = x^2 - 8x + 19$

(a) Express $f(x)$ in the form $(x + a)^2 + b$, where a and b are constants.

(2)

The curve C with equation $y = f(x)$ crosses the y-axis at the point P and has a minimum point at the point Q.

(b) Sketch the graph of C showing the coordinates of point P and the coordinates of point Q.

(3)

(c) Find the distance PQ, writing your answer as a simplified surd.

(3)

(Total 8 marks)

11*. $f(x) = x^2 + (k + 3)x + k$,

where k is a real constant.

(a) Find the discriminant of $f(x)$ in terms of k.

(2)

(b) Show that the discriminant of $f(x)$ can be expressed in the form $(k + a)^2 + b$, where a and b are integers to be found.

(2)

(c) Show that, for all values of k, the equation $f(x) = 0$ has real roots.

(2)

(Total 6 marks)

12*. $$4x - 5 - x^2 = q - (x + p)^2,$$

where p and q are integers.

(a) Find the value of p and the value of q.

(3)

(b) Calculate the discriminant of $4x - 5 - x^2$.

(2)

(c) Sketch the curve with equation $y = 4x - 5 - x^2$, showing clearly the coordinates of any points where the curve crosses the coordinate axes.

(3)

(Total 8 marks)

13*. Given that $y = 2^x$,

(a) express 4^x in terms of y.

(1)

(b) Hence, or otherwise, solve

$$8(4^x) - 9(2^x) + 1 = 0.$$

(4)

(Total 5 marks)

14*. Factorise completely $x - 4x^3$

(Total 3 marks)

15*. Factorise fully $25x - 9x^3$

(Total 3 marks)

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16. $f(x) = 2x^3 - 7x^2 - 10x + 24$.

(a) Use the factor theorem to show that $(x + 2)$ is a factor of $f(x)$.

(2)

(b) Factorise $f(x)$ completely.

(4)

(Total 6 marks)

---

17. $f(x) = 2x^3 - 7x^2 + 4x + 4$.

(a) Use the factor theorem to show that $(x - 2)$ is a factor of $f(x)$.

(2)

(b) Factorise $f(x)$ completely.

(4)

(Total 6 marks)

TOTAL FOR PAPER: 80 MARKS

Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number	Candidate Number

AS and A level Mathematics

Practice Paper
Pure Mathematics - Algebra (part 2)

You must have:
Mathematical Formulae and Statistical Tables (Pink)

Total Marks

Instructions

- Use black ink or ball-point pen.
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- Answer the questions in the spaces provided – there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 12 questions in this question paper. The total mark for this paper is 85.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.
- Calculators must not be used for all questions.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
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AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

1. Solve the simultaneous equations

$$x + y = 2$$

$$4y^2 - x^2 = 11$$

(Total 7 marks)

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2. Solve the simultaneous equations

$$y + 4x + 1 = 0$$

$$y^2 + 5x^2 + 2x = 0$$

(Total 6 marks)

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3. Solve the simultaneous equations

$$y - 2x - 4 = 0$$

$$4x^2 + y^2 + 20x = 0$$

(Total 7 marks)

---

4. Given the simultaneous equations

$$2x + y = 1$$

$$x^2 - 4ky + 5k = 0$$

where k is a non zero constant,

(a) show that $x^2 + 8kx + k = 0$.

(2)

Given that $x^2 + 8kx + k = 0$ has equal roots,

(b) find the value of k.

(3)

(c) For this value of k, find the solution of the simultaneous equations.

(3)

(Total 8 marks)

---

5. Find the set of values of x for which

(*a*) $4x - 5 > 15 - x$,

(2)

(*b*) $x(x - 4) > 12$.

(4)

(Total 6 marks)

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6. Find the set of values of x for which

(a) $2(3x + 4) > 1 - x$,

(2)

(b) $3x^2 + 8x - 3 < 0$.

(4)

(Total 6 marks)

---

7. Find the set of values of x for which

(a) $3x - 7 > 3 - x$,

(2)

(b) $x^2 - 9x \leq 36$,

(4)

(c) **both** $3x - 7 > 3 - x$ **and** $x^2 - 9x \leq 36$.

(1)

(Total 7 marks)

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8. The equation $x^2 + (k - 3)x + (3 - 2k) = 0$, where k is a constant, has two distinct real roots.

(a) Show that k satisfies

$$k^2 + 2k - 3 > 0$$

(3)

(b) Find the set of possible values of k.

(4)

(Total 7 marks)

---

9. The equation

$$(k + 3)x^2 + 6x + k = 5, \text{ where } k \text{ is a constant,}$$

has two distinct real solutions for x.

(a) Show that k satisfies

$$k^2 - 2k - 24 < 0.$$

(4)

(b) Hence find the set of possible values of k.

(3)

(Total 7 marks)

---

10. The equation

$$(p - 1)x^2 + 4x + (p - 5) = 0, \text{ where } p \text{ is a constant,}$$

has no real roots.

(a) Show that p satisfies $p^2 - 6p + 1 > 0$.

(3)

(b) Hence find the set of possible values of p.

(4)

(Total 7 marks)

---

11. The straight line with equation $y = 3x - 7$ does not cross or touch the curve with equation $y = 2px^2 - 6px + 4p$, where p is a constant.

(a) Show that $4p^2 - 20p + 9 < 0$.

(4)

(b) Hence find the set of possible values of p.

(4)

(Total 8 marks)

12.

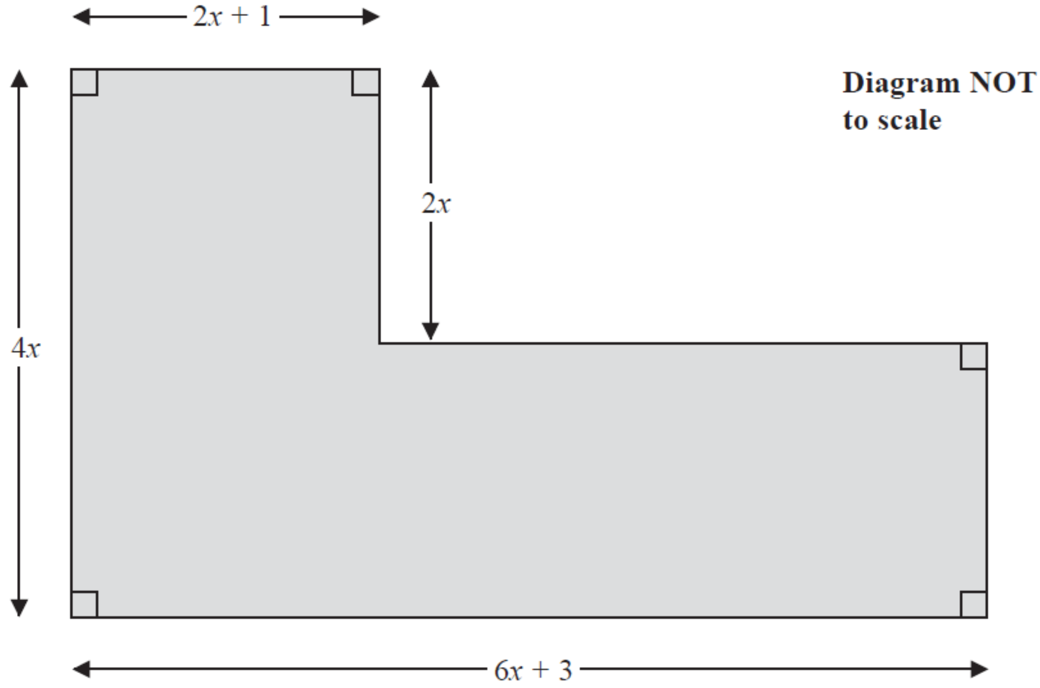

Figure 1

Figure 1 shows the plan of a garden. The marked angles are right angles.

The six edges are straight lines.

The lengths shown in the diagram are given in metres.

Given that the perimeter of the garden is greater than 40 m,

(a) show that $x > 1.7$.

(3)

Given that the area of the garden is less than 120 m^2,

(b) form and solve a quadratic inequality in x.

(5)

(c) Hence state the range of the possible values of x.

(1)

(Total 9 marks)

TOTAL FOR PAPER: 85 MARKS

Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number

Candidate Number

AS and A level Mathematics

Practice Paper
Pure Mathematics - Binomial expansion

You must have:
Mathematical Formulae and Statistical Tables (Pink)

Total Marks

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all the questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 9 questions in this question paper. The total mark for this paper is 49.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

1. Find the first 3 terms, in ascending powers of x, of the binomial expansion of

$$(2 - 3x)^5,$$

giving each term in its simplest form.

(4)

(Total 4 marks)

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2. Find the first 4 terms, in ascending powers of x, of the binomial expansion of

$$\left(3 - \frac{1}{3}x\right)^5$$

giving each term in its simplest form.

(Total 4 marks)

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3. Find the first 3 terms, in ascending powers of x, of the binomial expansion of

$$\left(2 - \frac{x}{4}\right)^{10},$$

giving each term in its simplest form.

(Total 4 marks)

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4. Find the first 4 terms, in ascending powers of x, of the binomial expansion of

$$\left(1 + \frac{3x}{2}\right)^8$$

giving each term in its simplest form.

(Total 4 marks)

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5. (a) Find the first 3 terms, in ascending powers of x, of the binomial expansion of

$$(3 + bx)^5$$

where b is a non-zero constant. Give each term in its simplest form.

(4)

Given that, in this expansion, the coefficient of x^2 is twice the coefficient of x,

(b) find the value of b.

(2)

(Total 6 marks)

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6. (a) Find the first 4 terms of the binomial expansion, in ascending powers of x, of

$$\left(1+\frac{x}{4}\right)^8,$$

giving each term in its simplest form.

(4)

(b) Use your expansion to estimate the value of $(1.025)^8$, giving your answer to 4 decimal places.

(3)

(Total 7 marks)

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7. (a) Find the first 3 terms, in ascending powers of x, of the binomial expansion of $(2 - 3x)^6$, giving each term in its simplest form.

(4)

(b) Hence, or otherwise, find the first 3 terms, in ascending powers of x, of the expansion of

$$\left(1+\frac{x}{2}\right)(2-3x)^6.$$

(3)

(Total 7 marks)

---

8. Given that $\binom{40}{4} = \frac{40!}{4!b!}$,

(a) write down the value of b.

(1)

In the binomial expansion of $(1 + x)^{40}$, the coefficients of x^4 and x^5 are p and q respectively.

(b) Find the value of $\frac{q}{p}$.

(3)

(Total 4 marks)

---

9. (a) Find the first 3 terms, in ascending powers of x, of the binomial expansion of

$$(2 - 9x)^4,$$

giving each term in its simplest form.

(4)

$$f(x) = (1 + kx)(2 - 9x)^4, \quad \text{where } k \text{ is a constant.}$$

The expansion, in ascending powers of x, of f(x) up to and including the term in x^2 is

$$A - 232x + Bx^2,$$

where A and B are constants.

(b) Write down the value of A.

(1)

(c) Find the value of k.

(2)

(d) Hence find the value of B.

(2)

(Total 9 marks)

TOTAL FOR PAPER: 49 MARKS

Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number	Candidate Number

AS and A level Mathematics

Practice Paper
Pure Mathematics - Coordinate geometry

You must have:
Mathematical Formulae and Statistical Tables (Pink)

Total Marks

Instructions

- Use black ink or ball-point pen.
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- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 12 questions in this question paper. The total mark for this paper is 100.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.
- Calculators must not be used for questions marked with a * sign.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
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AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

1*. The points P and Q have coordinates (–1, 6) and (9, 0) respectively.

The line l is perpendicular to PQ and passes through the mid-point of PQ.

Find an equation for l, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(Total 5 marks)

2*.

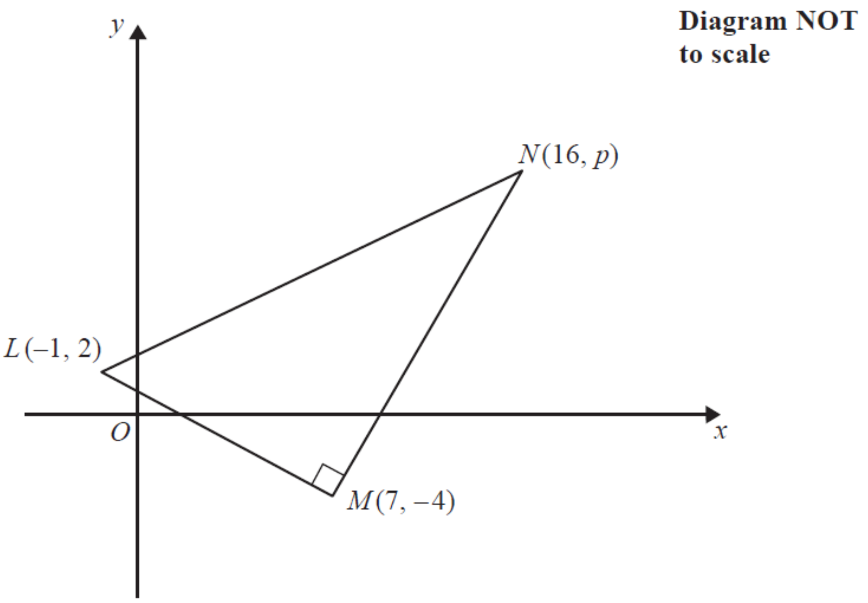


Figure 1

Figure 1 shows a right angled triangle LMN.

The points L and M have coordinates (–1, 2) and (7, –4) respectively.

(a) Find an equation for the straight line passing through the points L and M.

Give your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

Given that the coordinates of point N are (16, p), where p is a constant, and angle LMN = 90°,

(b) find the value of p.

(3)

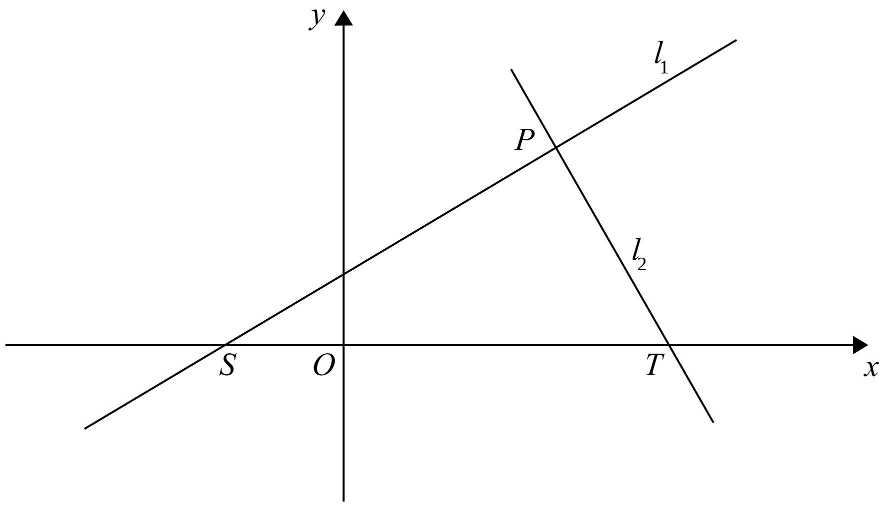
Given that there is a point K such that the points L, M, N, and K form a rectangle,

(c) find the y coordinate of K.

(2)

(Total 9 marks)

3*.



Not to scale

Figure 1

The straight line l_1 , shown in Figure 1, has equation $5y = 4x + 10$

The point P with x coordinate 5 lies on l_1

The straight line l_2 is perpendicular to l_1 and passes through P.

(a) Find an equation for l_2 , writing your answer in the form $ax + by + c = 0$ where a, b and c are integers.

(4)

The lines l_1 and l_2 cut the x-axis at the points S and T respectively, as shown in Figure 1.

(b) Calculate the area of triangle SPT.

(4)

(Total 8 marks)

4*.

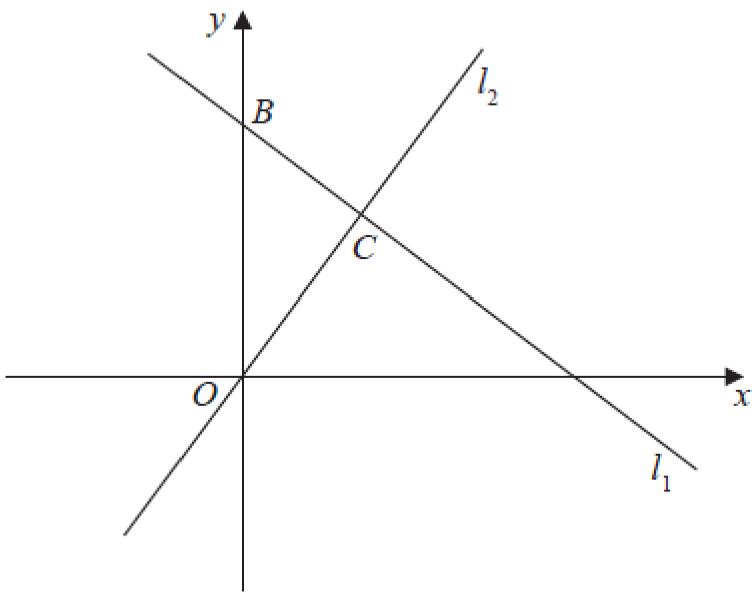


Figure 2

The line l_1, shown in Figure 2 has equation $2x + 3y = 26$.

The line l_2 passes through the origin O and is perpendicular to l_1.

(a) Find an equation for the line l_2.

(4)

The line l_2 intersects the line l_1 at the point C. Line l_1 crosses the y-axis at the point B as shown in Figure 2.

(b) Find the area of triangle OBC. Give your answer in the form $\frac{a}{b}$, where a and b are integers to be determined.

(6)

(Total 10 marks)

5*. The line L_1 has equation $4y + 3 = 2x$.

The point A (p, 4) lies on L_1.

(a) Find the value of the constant p.

(1)

The line L_2 passes through the point C (2, 4) and is perpendicular to L_1.

(b) Find an equation for L_2 giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

The line L_1 and the line L_2 intersect at the point D.

(c) Find the coordinates of the point D.

(3)

(d) Show that the length of CD is $\frac{3}{2}\sqrt{5}$.

(3)

A point B lies on L_1 and the length of $AB = \sqrt{80}$.

The point E lies on L_2 such that the length of the line CDE = 3 times the length of CD.

(e) Find the area of the quadrilateral $ACBE$.

(3)

(Total 15 marks)

6*.

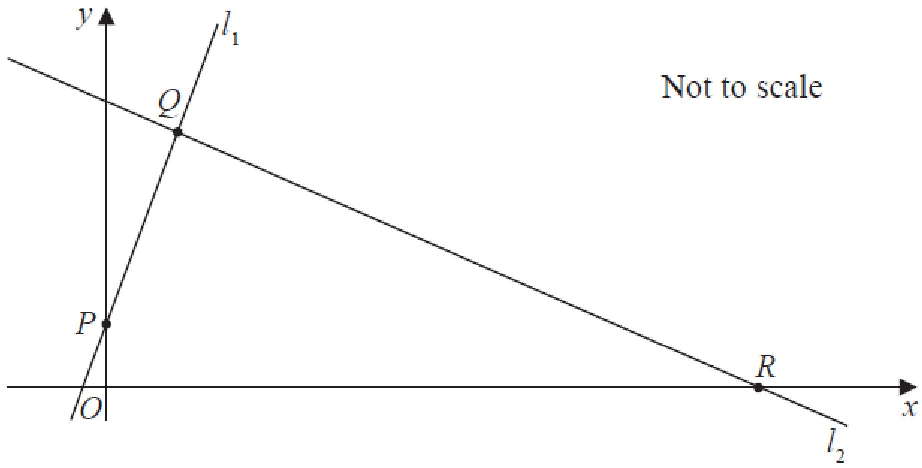


Figure 3

The points P (0, 2) and Q (3, 7) lie on the line l_1, as shown in Figure 3.

The line l_2 is perpendicular to l_1, passes through Q and crosses the x-axis at the point R, as shown in Figure 3.

Find

(a) an equation for l_2, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers,

(5)

(b) the exact coordinates of R,

(2)

(c) the exact area of the quadrilateral $ORQP$, where O is the origin.

(5)

(Total 12 marks)

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7. A circle C has centre $(-1, 7)$ and passes through the point $(0, 0)$. Find an equation for C.

(Total 4 marks)

8.

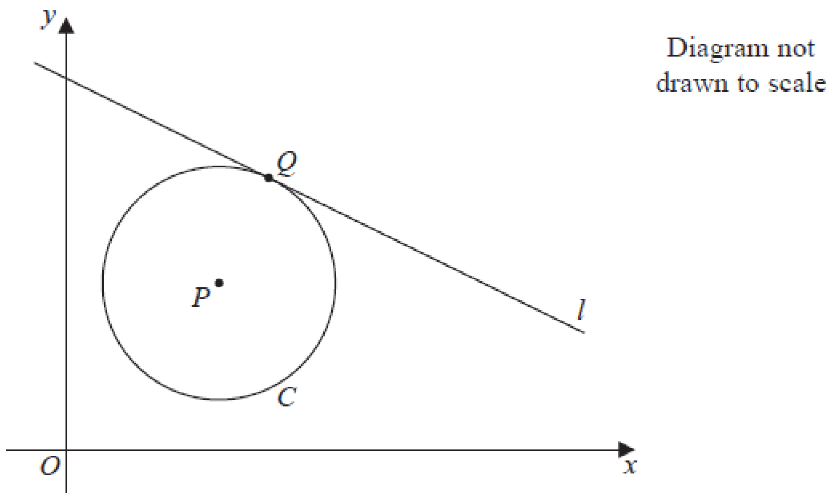

Figure 4

The circle C has centre $P(7, 8)$ and passes through the point $Q(10, 13)$, as shown in Figure 4.

(a) Find the length PQ, giving your answer as an exact value.

(2)

(b) Hence write down an equation for C.

(2)

The line l is a tangent to C at the point Q, as shown in Figure 4.

(c) Find an equation for l, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

(Total 8 marks)

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9. The circle C has equation

$$x^2 + y^2 + 4x - 2y - 11 = 0.$$

Find

(a) the coordinates of the centre of C,

(2)

(b) the radius of C,

(2)

(c) the coordinates of the points where C crosses the y-axis, giving your answers as simplified surds.

(4)

(Total 8 marks)

10. The circle C has equation

$$x^2 + y^2 - 10x + 6y + 30 = 0$$

Find

(a) the coordinates of the centre of C,

(2)

(b) the radius of C,

(2)

(c) the y coordinates of the points where the circle C crosses the line with equation $x = 4$, giving your answers as simplified surds.

(3)

(Total 7 marks)

11.

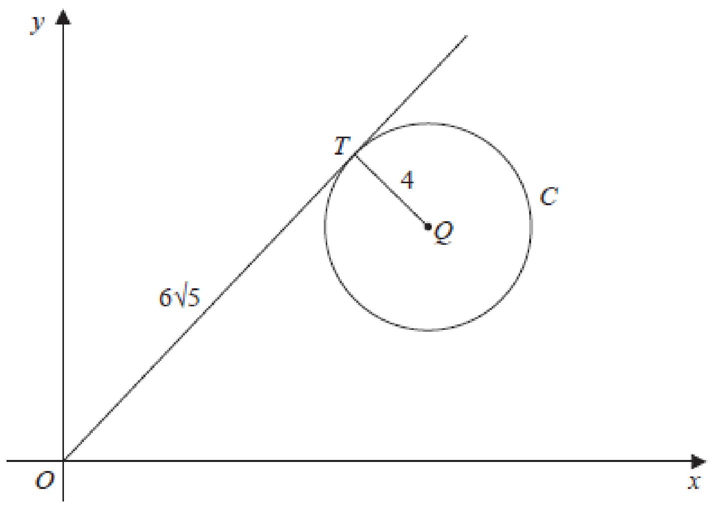

Figure 5

Figure 5 shows a circle C with centre Q and radius 4 and the point T which lies on C. The tangent to C at the point T passes through the origin O and $OT = 6\sqrt{5}$.

Given that the coordinates of Q are $(11, k)$, where k is a positive constant,

(a) find the exact value of k,

(3)

(b) find an equation for C.

(2)

(Total 5 marks)

12. The circle C, with centre A, passes through the point P with coordinates (–9, 8) and the point Q with coordinates (15, –10).

Given that PQ is a diameter of the circle C,

(a) find the coordinates of A,

(2)

(b) find an equation for C.

(3)

A point R also lies on the circle C.

Given that the length of the chord PR is 20 units,

(c) find the length of the shortest distance from A to the chord PR.

Give your answer as a surd in its simplest form.

(2)

(d) Find the size of the angle ARQ, giving your answer to the nearest 0.1 of a degree.

(2)

(Total 9 marks)

TOTAL FOR PAPER: 100 MARKS

Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number	Candidate Number

AS and A level Mathematics

Practice Paper
Pure Mathematics - Differentiation

You must have:
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Total Marks

Instructions

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Information

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- There are 11 questions in this question paper. The total mark for this paper is 99.
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AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

1*. Given

$$y = \sqrt{x} + \frac{4}{\sqrt{x}} + 4, \qquad x > 0$$

find the value of $\frac{dy}{dx}$ when $x = 8$, writing your answer in the form $a\sqrt{2}$, where a is a rational number.

(Total 5 marks)

2*. Given that

$$y = 3x^2 + 6x^{\frac{1}{3}} + \frac{2x^3 - 7}{3\sqrt{x}}, \quad x > 0,$$

find $\frac{dy}{dx}$. Give each term in your answer in its simplified form.

(Total 6 marks)

3*. Differentiate with respect to x, giving answer in its simplest form

$$\frac{x^5 + 6\sqrt{x}}{2x^2}$$

(Total 4 marks)

4*. $$y = 5x^3 - 6x^{\frac{4}{3}} + 2x - 3.$$

(a) Find $\frac{dy}{dx}$, giving each term in its simplest form.

(4)

(b) Find $\frac{d^2y}{dx^2}$

(2)

(Total 6 marks)

5.

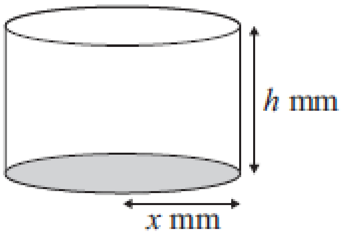

Figure 1

A manufacturer produces pain relieving tablets. Each tablet is in the shape of a solid circular cylinder with base radius *x* mm and height h mm, as shown in Figure 1.

Given that the volume of each tablet has to be 60 mm^3,

(a) express *h* in terms of *x*,

(1)

(b) show that the surface area, *A* mm^2, of a tablet is given by $A = 2\pi x^2 + \frac{120}{x}$.

(3)

The manufacturer needs to minimise the surface area *A* mm^2, of a tablet.

(c) Use calculus to find the value of *x* for which *A* is a minimum.

(5)

(d) Calculate the minimum value of *A*, giving your answer to the nearest integer.

(2)

(e) Show that this value of *A* is a minimum.

(2)

(Total 13 marks)

6. A solid glass cylinder, which is used in an expensive laser amplifier, has a volume of 75π cm^3.

The cost of polishing the surface area of this glass cylinder is £2 per cm^2 for the curved surface area and £3 per cm^2 for the circular top and base areas.

Given that the radius of the cylinder is r cm,

(a) show that the cost of the polishing, £C, is given by

$$C = 6\pi r^2 + \frac{300\pi}{r}.$$

(4)

(b) Use calculus to find the minimum cost of the polishing, giving your answer to the nearest pound.

(5)

(c) Justify that the answer that you have obtained in part (*b*) is a minimum.

(1)

(Total 10 marks)

7.

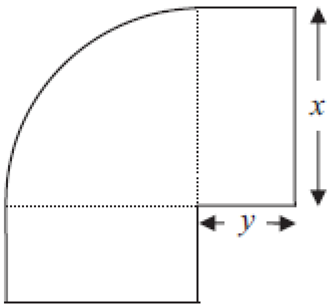

Figure 2

Figure 2 shows a flowerbed. Its shape is a quarter of a circle of radius x metres with two equal rectangles attached to it along its radii. Each rectangle has length equal to x metres and width equal to y metres.

Given that the area of the flowerbed is 4m^2,

(a) show that

$$y = \frac{16 - \pi x^2}{8x}.$$

(3)

(b) Hence show that the perimeter P metres of the flowerbed is given by the equation

$$P = \frac{8}{x} + 2x.$$

(3)

(c) Use calculus to find the minimum value of P.

(5)

(d) Find the width of each rectangle when the perimeter is a minimum.

Give your answer to the nearest centimetre.

(2)

(Total 13 marks)

8.

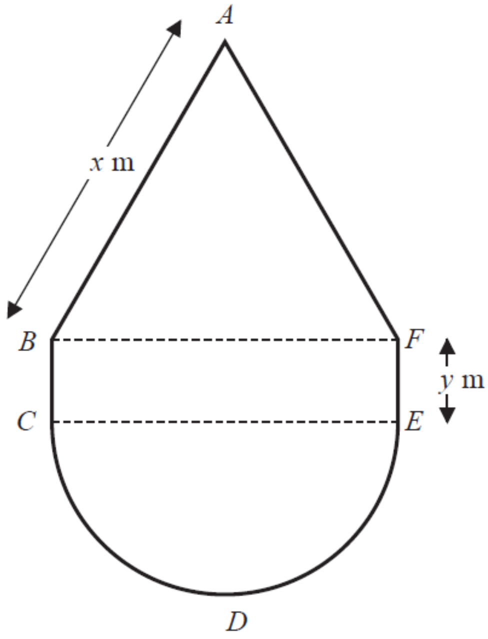

Figure 3

Figure 3 shows the plan of a pool.

The shape of the pool *ABCDEFA* consists of a rectangle *BCEF* joined to an equilateral triangle *BFA* and a semi-circle *CDE*, as shown in Figure 3.

Given that *AB* = x metres, *EF* = y metres, and the area of the pool is 50 m^2,

(a) show that

$$y = \frac{50}{x} - \frac{x}{8}\left(\pi + 2\sqrt{3}\right)$$

(3)

(b) Hence show that the perimeter, P metres, of the pool is given by

$$P = \frac{100}{x} + \frac{x}{4}\left(\pi + 8 - 2\sqrt{3}\right)$$

(3)

(c) Use calculus to find the minimum value of P, giving your answer to 3 significant figures.

(5)

(d) Justify, by further differentiation, that the value of P that you have found is a minimum.

(2)

(Total 13 marks)

9. The volume V cm^3 of a box, of height x cm, is given by

$$V = 4x(5 - x)^2, \quad 0 < x < 5.$$

(a) Find $\dfrac{dV}{dx}$.

(4)

(b) Hence find the maximum volume of the box.

(4)

(c) Use calculus to justify that the volume that you found in part (*b*) is a maximum.

(2)

(Total 10 marks)

---

10. Joan brings a cup of hot tea into a room and places the cup on a table. At time t minutes after Joan places the cup on the table, the temperature, θ °C, of the tea is modelled by the equation

$$\theta = 20 + Ae^{-kt},$$

where A and k are positive constants.

Given that the initial temperature of the tea was 90 °C,

(a) find the value of A.

(2)

The tea takes 5 minutes to decrease in temperature from 90 °C to 55 °C.

(b) Show that $k = \dfrac{1}{5}\ln 2$.

(3)

(c) Find the rate at which the temperature of the tea is decreasing at the instant when $t = 10$. Give your answer, in °C per minute, to 3 decimal places.

(3)

(Total 8 marks)

---

11. The mass, m grams, of a leaf t days after it has been picked from a tree is given by

$$m = pe^{-kt},$$

where k and p are positive constants.

When the leaf is picked from the tree, its mass is 7.5 grams and 4 days later its mass is 2.5 grams.

(a) Write down the value of p.

(1)

(b) Show that $k = \frac{1}{4} \ln 3$.

(4)

(c) Find the value of t when $\frac{dm}{dt} = -0.6 \ln 3$.

(6)

(Total 11 marks)

TOTAL FOR PAPER: 100 MARKS

Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number

Candidate Number

AS and A level Mathematics

Practice Paper
Pure Mathematics - Differentiation

You must have:
Mathematical Formulae and Statistical Tables (Pink)

Total Marks

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all the questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 9 questions in this question paper. The total mark for this paper is 100.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.
- Calculators must not be used for questions marked with a * sign.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

1*. The curve C_1 has equation

$$y = x^2(x + 2).$$

(a) Find $\dfrac{dy}{dx}$.

(2)

(b) Sketch C_1, showing the coordinates of the points where C_1 meets the x-axis.

(3)

(c) Find the gradient of C_1 at each point where C_1 meets the x-axis.

(2)

The curve C_2 has equation

$$y = (x - k)^2(x - k + 2),$$

where k is a constant and $k > 2$.

(d) Sketch C_2, showing the coordinates of the points where C_2 meets the x and y axes.

(3)

(Total 10 marks)

2*. The curve C has equation

$$y = (x + 1)(x + 3)^2.$$

(a) Sketch C, showing the coordinates of the points at which C meets the axes.

(4)

(b) Show that $\dfrac{dy}{dx} = 3x^2 + 14x + 15$.

(3)

The point A, with x-coordinate –5, lies on C.

(c) Find the equation of the tangent to C at A, giving your answer in the form $y = mx + c$, where m and c are constants.

(4)

Another point B also lies on C. The tangents to C at A and B are parallel.

(d) Find the x-coordinate of B.

(3)

(Total 14 marks)

3*. The curve C has equation

$$y = \frac{(x^2+4)(x-3)}{2x}, \quad x \neq 0.$$

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ in its simplest form.

(5)

(b) Find an equation of the tangent to C at the point where $x = -1$.

Give your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

(Total 10 marks)

4*. The curve C has equation $y = 2x^3 + kx^2 + 5x + 6$, where k is a constant.

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$.

(2)

The point P, where $x = -2$, lies on C.

The tangent to C at the point P is parallel to the line with equation $2y - 17x - 1 = 0$.

Find

(b) the value of k,

(4)

(c) the value of the y coordinate of P,

(2)

(d) the equation of the tangent to C at P, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(2)

(Total 10 marks)

5*. The curve C has equation

$$y = 2x - 8\sqrt{x} + 5, \quad x \geq 0.$$

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$, giving each term in its simplest form.

(3)

The point P on C has x-coordinate equal to $\frac{1}{4}$.

(b) Find the equation of the tangent to C at the point P, giving your answer in the form $y = ax + b$, where a and b are constants.

(4)

The tangent to C at the point Q is parallel to the line with equation $2x - 3y + 18 = 0$.

(c) Find the coordinates of Q.

(5)

(Total 12 marks)

6*. The curve C has equation

$$y = \frac{1}{2}x^3 - 9x^{\frac{3}{2}} + \frac{8}{x} + 30, \qquad x > 0.$$

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$

(4)

(b) Show that the point $P(4, –8)$ lies on C

(2)

(c) Find an equation of the normal to C at the point P, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(6)

(Total 12 marks)

7*.

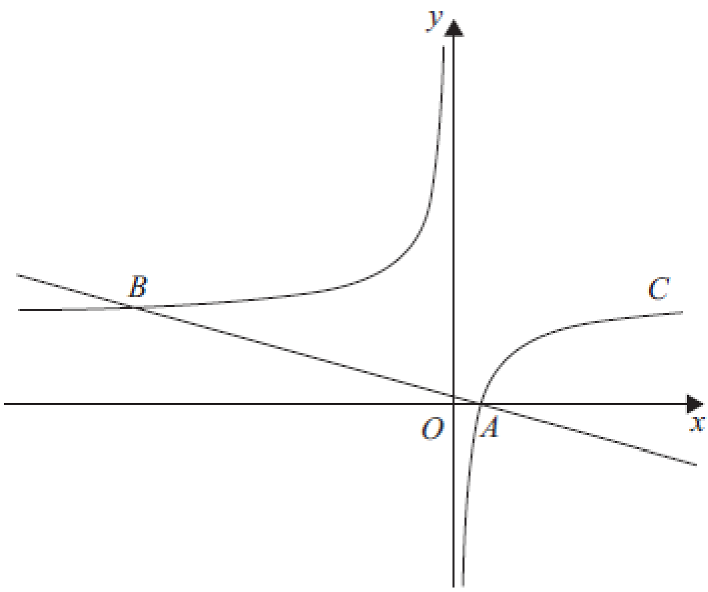

Figure 1

Figure 1 shows a sketch of the curve C with equation

$$y = 2 - \frac{1}{x}, \qquad x \neq 0.$$

The curve crosses the x-axis at the point A.

(a) Find the coordinates of A.

(1)

(b) Show that the equation of the normal to C at A can be written as

$$2x + 8y - 1 = 0.$$

(6)

The normal to C at A meets C again at the point B, as shown in Figure 1.

(c) Find the coordinates of B.

(4)

(Total 11 marks)

8*.

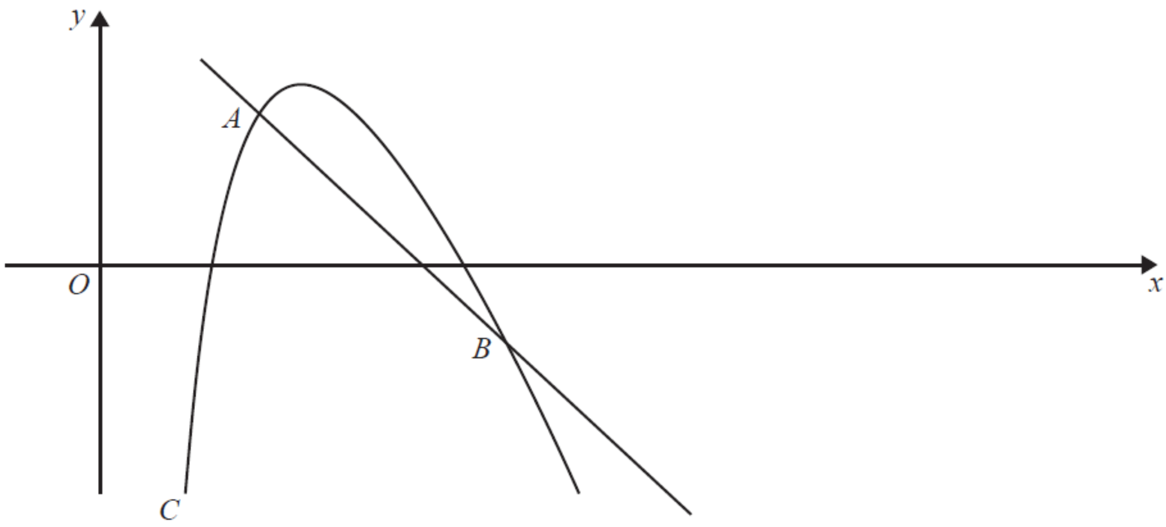

Figure 2

A sketch of part of the curve C with equation

$$y = 20 - 4x - \frac{18}{x}, \qquad x > 0$$

is shown in Figure 2.

Point A lies on C and has an x coordinate equal to 2.

(a) Show that the equation of the normal to C at A is $y = -2x + 7$.

(6)

The normal to C at A meets C again at the point B, as shown in Figure 2.

(b) Use algebra to find the coordinates of B.

(5)

(Total 11 marks)

9.

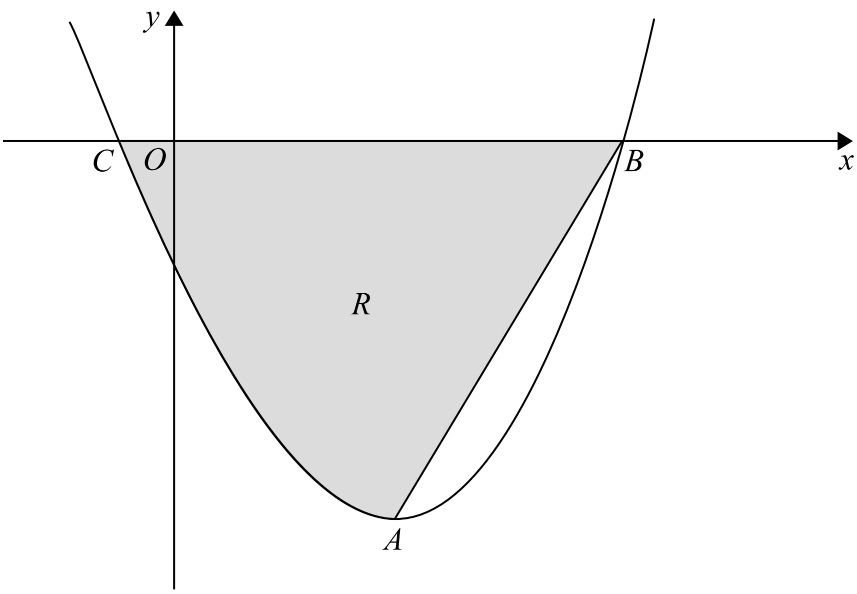

Figure 3

Figure 3 shows a sketch of part of the curve with equation

$$y = 4x^3 + 9x^2 - 30x - 8, \qquad -0.5 \leqslant x \leqslant 2.2$$

The curve has a turning point at the point A.

(a) Using calculus, show that the x coordinate of A is 1

(3)

The curve crosses the x-axis at the points B (2, 0) and $C\left(-\frac{1}{4}, 0\right)$

The finite region R, shown shaded in Figure 3, is bounded by the curve, the line AB, and the x-axis.

(b) Use integration to find the area of the finite region R, giving your answer to 2 decimal places.

(7)

(Total 10 marks)

TOTAL FOR PAPER: 100 MARKS

AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number

Candidate Number

AS and A level Mathematics

Practice Paper
Pure Mathematics - Exponentials and logarithms

You must have:
Mathematical Formulae and Statistical Tables (Pink)

Total Marks

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all the questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 12 questions in this question paper. The total mark for this paper is 79.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

1. Find the values of x such that

$$2 \log_3 x - \log_3(x - 2) = 2$$

(Total 5 marks)

---

2. Given that $y = 3x^2$,

(a) show that $\log_3 y = 1 + 2 \log_3 x$.

(3)

(b) Hence, or otherwise, solve the equation

$$1 + 2 \log_3 x = \log_3 (28x - 9).$$

(3)

(Total 6 marks)

---

3. Given that $2 \log_2 (x + 15) - \log_2 x = 6$,

(a) show that $x^2 - 34x + 225 = 0$.

(5)

(b) Hence, or otherwise, solve the equation $2 \log_2 (x + 15) - \log_2 x = 6$.

(2)

(Total 7 marks)

---

4. (i) Find the exact value of x for which

$$\log_2 (2x) = \log_2 (5x + 4) - 3.$$

(4)

(ii) Given that

$$\log_a y + 3 \log_a 2 = 5,$$

express y in terms of a.

Give your answer in its simplest form.

(3)

(Total 7 marks)

---

5. (i) $2 \log(x + a) = \log(16a^6)$, where a is a positive constant

Find x in terms of a, giving your answer in its simplest form.

(3)

(ii) $\log_3(9y + b) - \log_3(2y - b) = 2$, where b is a positive constant

Find y in terms of b, giving your answer in its simplest form.

(4)

(Total 7 marks)

---

6. Find, giving your answer to 3 significant figures where appropriate, the value of x for which

(a) $5^x = 10$,

(2)

(b) $\log_3 (x - 2) = -1$.

(2)

(Total 4 marks)

---

7. Find the exact solutions, in their simplest form, to the equations

(a) $e^{3x - 9} = 8$

(Total 3 marks)

---

8. $$f(x) = -6x^3 - 7x^2 + 40x + 21$$

(a) Use the factor theorem to show that $(x + 3)$ is a factor of $f(x)$

(2)

(b) Factorise $f(x)$ completely.

(4)

(c) Hence solve the equation

$$6(2^{3y}) + 7(2^{2y}) = 40(2^y) + 21$$

giving your answer to 2 decimal places.

(3)

(Total 9 marks)

---

9. (i) Use logarithms to solve the equation $8^{2x + 1} = 24$, giving your answer to 3 decimal places.

(3)

(ii) Find the values of y such that

$$\log_2 (11y - 3) - \log_2 3 - 2 \log_2 y = 1, \qquad y > \frac{3}{11}$$

(6)

(Total 9 marks)

---

10. (i) Given that

$$\log_3(3b + 1) - \log_3(a - 2) = -1, \qquad a > 2,$$

express b in terms of a.

(3)

(ii) Solve the equation

$$2^{2x + 5} - 7(2^x) = 0,$$

giving your answer to 2 decimal places.

(*Solutions based entirely on graphical or numerical methods are not acceptable.*)

(4)

(Total 7 marks)

---

11. (i) Solve

$$5^y = 8$$

giving your answers to 3 significant figures.

(2)

(ii) Use algebra to find the values of x for which

$$\log_2(x+15) - 4 = \frac{1}{2}\log_2 x$$

(6)

(Total 8 marks)

---

12. (a) Sketch the graph of

$$y = 3^x, x \in \mathbb{R},$$

showing the coordinates of any points at which the graph crosses the axes.

(2)

(b) Use algebra to solve the equation $3^{2x} - 9(3^x) + 18 = 0$, giving your answers to 2 decimal places where appropriate.

(5)

(Total 7 marks)

TOTAL FOR PAPER: 79 MARKS

Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number

Candidate Number

AS and A level Mathematics

Practice Paper
Pure Mathematics - Graphs and transformations

You must have: Mathematical Formulae and Statistical Tables (Pink)	Total Marks

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
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- Answer the questions in the spaces provided – there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 12 questions in this question paper. The total mark for this paper is 100.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.
- **Calculators must not be used for all questions.**

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

1.

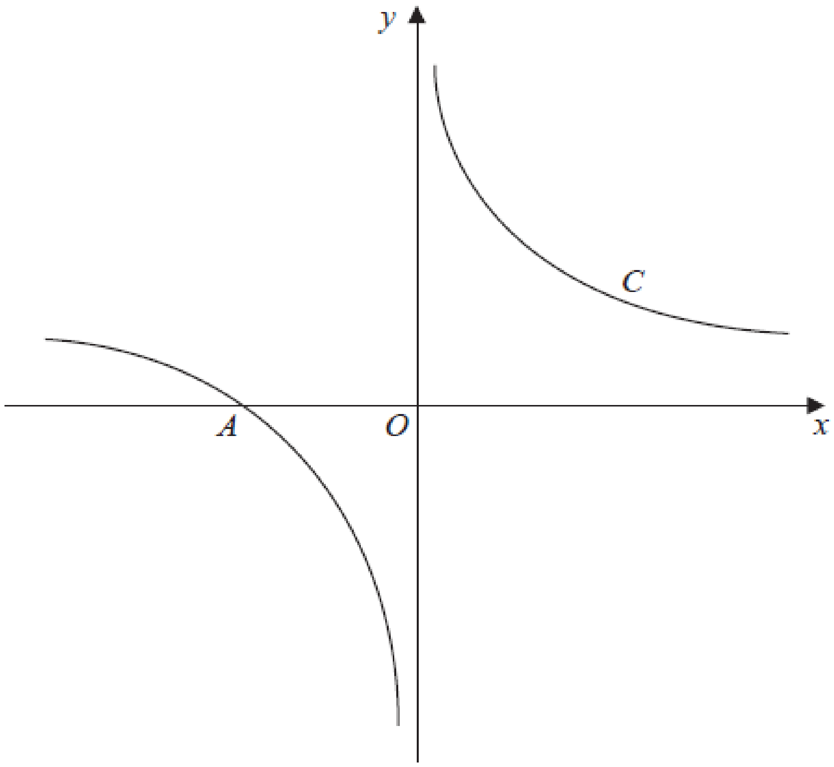


Figure 1

Figure 1 shows a sketch of the curve C with equation

$$y = \frac{1}{x} + 1, \qquad x \neq 0.$$

The curve C crosses the x-axis at the point A.

(a) State the x-coordinate of the point A.

(1)

The curve D has equation $y = x^2(x - 2)$, for all real values of x.

(b) On a copy of Figure 1, sketch a graph of curve D. Show the coordinates of each point where the curve D crosses the coordinate axes.

(3)

(c) Using your sketch, state, giving a reason, the number of real solutions to the equation

$$x^2(x - 2) = \frac{1}{x} + 1$$

(1)

(Total 5 marks)

2.

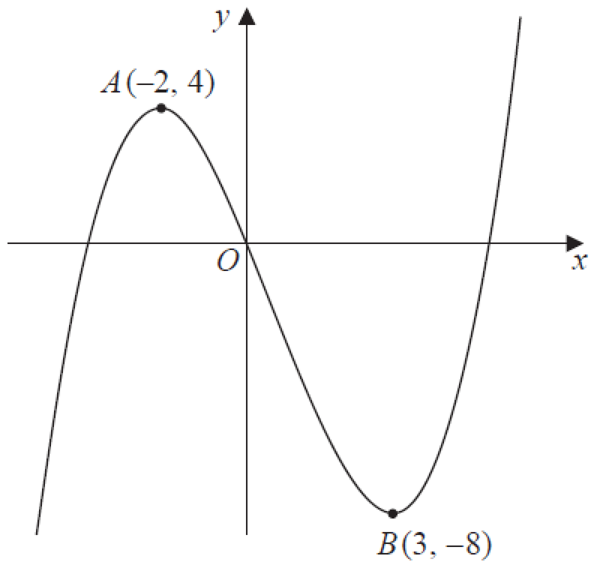


Figure 2

Figure 2 shows a sketch of part of the curve with equation $y = \mathrm{f}(x)$. The curve has a maximum point A at (–2, 4) and a minimum point B at (3, –8) and passes through the origin O.

On separate diagrams, sketch the curve with equation

(a) $y = 3\mathrm{f}(x)$,

(2)

(b) $y = \mathrm{f}(x) - 4$.

(3)

On each diagram, show clearly the coordinates of the maximum and the minimum points and the coordinates of the point where the curve crosses the y-axis.

(Total 5 marks)

3.

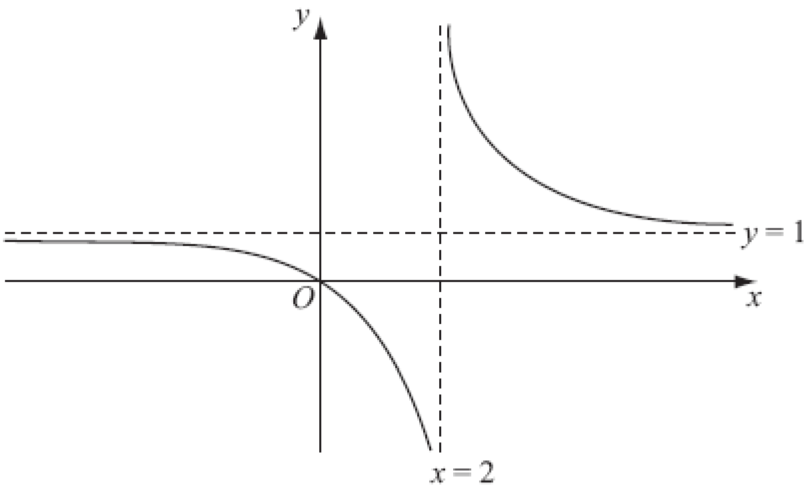


Figure 3

Figure 3 shows a sketch of the curve with equation $y = \text{f}(x)$ where

$$\text{f}(x) = \frac{x}{x - 2}, \qquad x \neq 2.$$

The curve passes through the origin and has two asymptotes, with equations $y = 1$ and $x = 2$, as shown in Figure 1.

(a) In the space below, sketch the curve with equation $y = \text{f}(x - 1)$ and state the equations of the asymptotes of this curve.

(3)

(b) Find the coordinates of the points where the curve with equation $y = \text{f}(x - 1)$ crosses the coordinate axes.

(4)

(Total 7 marks)

4.

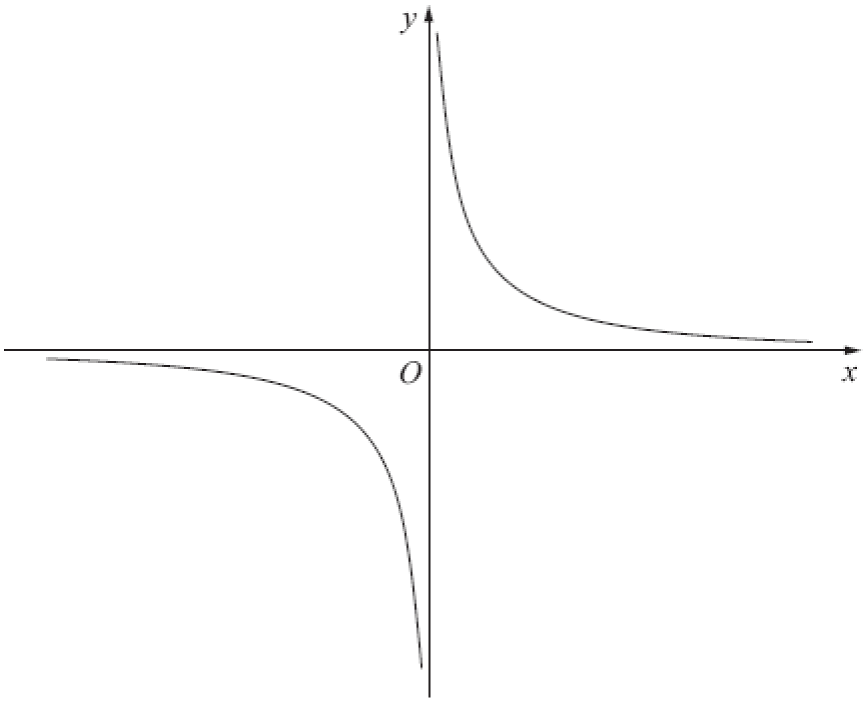


Figure 4

Figure 4 shows a sketch of the curve with equation $y = \frac{2}{x}$, $x \neq 0$.

The curve C has equation $y = \frac{2}{x} - 5$, $x \neq 0$, and the line l has equation $y = 4x + 2$.

(a) Sketch and clearly label the graphs of C and l on a single diagram.

On your diagram, show clearly the coordinates of the points where C and l cross the coordinate axes.

(5)

(b) Write down the equations of the asymptotes of the curve C.

(2)

(c) Find the coordinates of the points of intersection of $y = \frac{2}{x} - 5$ and $y = 4x + 2$.

(5)

(Total 12 marks)

5. (a) Factorise completely $9x - 4x^3$.

(3)

(b) Sketch the curve C with equation

$$y = 9x - 4x^3.$$

Show on your sketch the coordinates at which the curve meets the x-axis.

(3)

The points A and B lie on C and have x coordinates of –2 and 1 respectively.

(c) Show that the length of AB is $k\sqrt{10}$, where k is a constant to be found.

(4)

(Total 10 marks)

6.

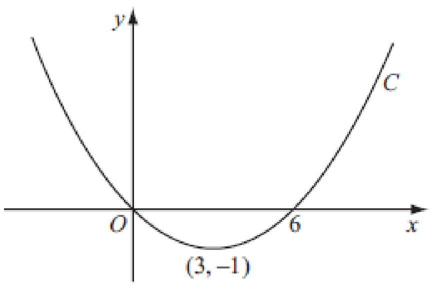


Figure 5

Figure 5 shows a sketch of the curve C with equation $y = \mathrm{f}(x)$.

The curve C passes through the origin and through (6, 0).

The curve C has a minimum at the point (3, –1).

On separate diagrams, sketch the curve with equation

(a) $y = \mathrm{f}(2x)$,

(3)

(b) $y = -\mathrm{f}(x)$,

(3)

(c) $y = \mathrm{f}(x + p)$, where p is a constant and $0 < p < 3$.

(4)

On each diagram show the coordinates of any points where the curve intersects the x-axis and of any minimum or maximum points.

(Total 10 marks)

7.

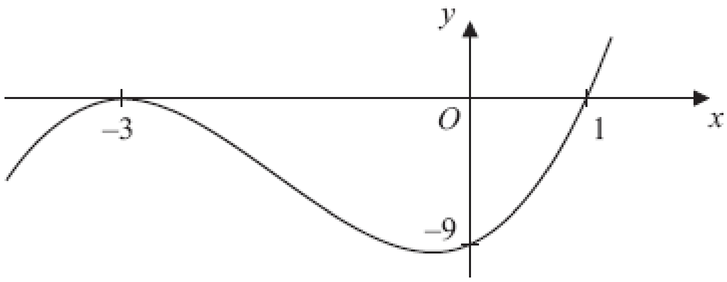


Figure 6

Figure 6 shows a sketch of the curve with equation $y = \mathrm{f}(x)$ where

$$\mathrm{f}(x) = (x + 3)^2\,(x - 1), \qquad x \in \mathbb{R}.$$

The curve crosses the x-axis at (1, 0), touches it at (–3, 0) and crosses the y-axis at (0, –9).

(a) Sketch the curve C with equation $y = \mathrm{f}(x + 2)$ and state the coordinates of the points where the curve C meets the x-axis.

(3)

(b) Write down an equation of the curve C.

(1)

(c) Use your answer to part (*b*) to find the coordinates of the point where the curve C meets the y-axis.

(2)

(Total 6 marks)

---

8. (a) On separate axes sketch the graphs of

(i) $y = -3x + c$, where c is a positive constant,

(ii) $y = \dfrac{1}{x} + 5$

On each sketch show the coordinates of any point at which the graph crosses the y-axis and the equation of any horizontal asymptote.

(4)

Given that $y = -3x + c$, where c is a positive constant, meets the curve $y = \dfrac{1}{x} + 5$ at two distinct points,

(b) show that $(5 - c)^2 > 12$

(3)

(c) Hence find the range of possible values for c.

(4)

(Total 11 marks)

---

9. $$4x^2 + 8x + 3 \equiv a(x + b)^2 + c$$

(a) Find the values of the constants a, b and c.

(3)

(b) Sketch the curve with equation $y = 4x^2 + 8x + 3$, showing clearly the coordinates of any points where the curve crosses the coordinate axes.

(4)

(Total 7 marks)

10.

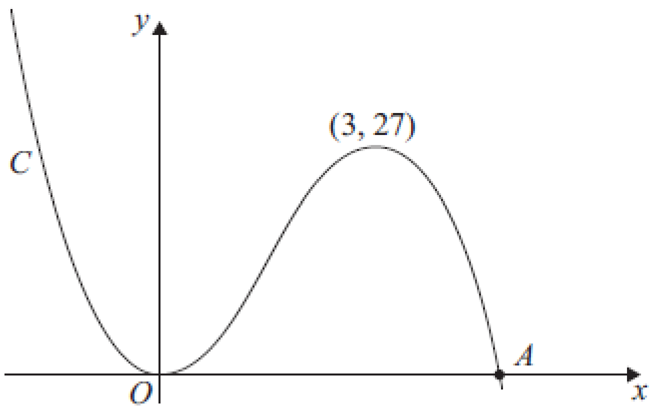


Figure 7

Figure 7 shows a sketch of the curve C with equation $y = f(x)$, where

$$f(x) = x^2(9 - 2x).$$

There is a minimum at the origin, a maximum at the point (3, 27) and C cuts the x-axis at the point A.

(a) Write down the coordinates of the point A.

(1)

(b) On separate diagrams sketch the curve with equation

(i) $y = f(x + 3)$,

(ii) $y = f(3x)$.

On each sketch you should indicate clearly the coordinates of the maximum point and any points where the curves cross or meet the coordinate axes.

(6)

The curve with equation $y = \mathrm{f}(x) + k$, where k is a constant, has a maximum point at (3, 10).

(c) Write down the value of k.

(1)

(Total 8 marks)

11.

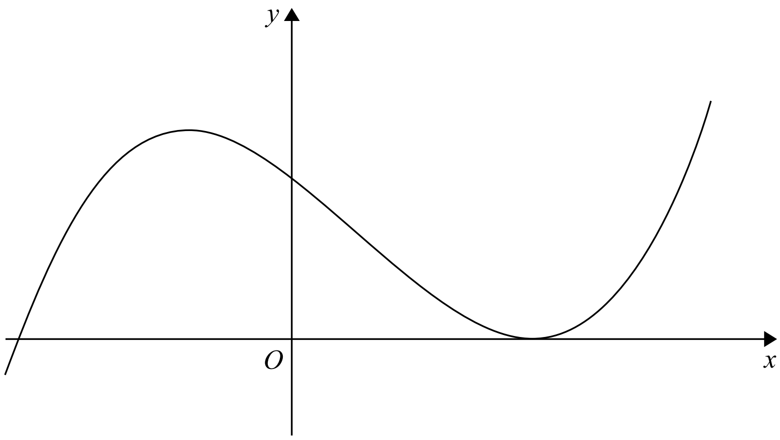


Figure 8

Figure 8 shows a sketch of part of the curve $y = \mathrm{f}(x)$, $x \in \mathbb{R}$, where

$$\mathrm{f}(x) = (2x - 5)^2 (x + 3)$$

(a) Given that

(i) the curve with equation $y = \mathrm{f}(x) - k$, $x \in \mathbb{R}$, passes through the origin, find the value of the constant k,

(ii) the curve with equation $y = \mathrm{f}(x + c)$, $x \in \mathbb{R}$, has a minimum point at the origin, find the value of the constant c.

(3)

(b) Show that $\mathrm{f}'(x) = 12x^2 - 16x - 35$

(3)

Points A and B are distinct points that lie on the curve $y = \mathrm{f}(x)$.

The gradient of the curve at A is equal to the gradient of the curve at B.

Given that point A has x coordinate 3

(c) find the x coordinate of point B.

(5)

(Total 11 marks)

---

12. (a) Sketch the graphs of

(i) $y = x(x + 2)(3 - x)$,

(ii) $y = -\dfrac{2}{x}$.

showing clearly the coordinates of all the points where the curves cross the coordinate axes.

(6)

(b) Using your sketch state, giving a reason, the number of real solutions to the equation

$$x(x + 2)(3 - x) + \frac{2}{x} = 0.$$

(2)

(Total 8 marks)

TOTAL FOR PAPER: 100 MARKS

Write your name here

Surname	Other names

Pearson
Edexcel GCE

Centre Number

Candidate Number

AS and A level Mathematics

Practice Paper
Pure Mathematics - Integration

You must have:
Mathematical Formulae and Statistical Tables (Pink)

Total Marks

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all the questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 14 questions in this question paper. The total mark for this paper is 100.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.
- Calculators must not be used for questions marked with a * sign.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

1*. Find

$$\int\left(6x^2+\frac{2}{x^2}+5\right)\mathrm{d}x,$$

giving each term in its simplest form.

(4)

(Total 4 marks)

2*. Find

$$\int\left(2x^4-\frac{4}{\sqrt{x}}+3\right)\mathrm{d}x$$

giving each term in its simplest form.

(Total 4 marks)

3*. Find

$$\int\left(2x^5-\frac{1}{4x^3}-5\right)\mathrm{d}x$$

giving each term in its simplest form.

(Total 4 marks)

---

4. Use integration to find

$$\int_1^{\sqrt{3}}\left(\frac{x^3}{6}+\frac{1}{3x^2}\right)\mathrm{d}x,$$

giving your answer in the form $a + b\sqrt{3}$, where a and b are constants to be determined.

(Total 5 marks)

5.

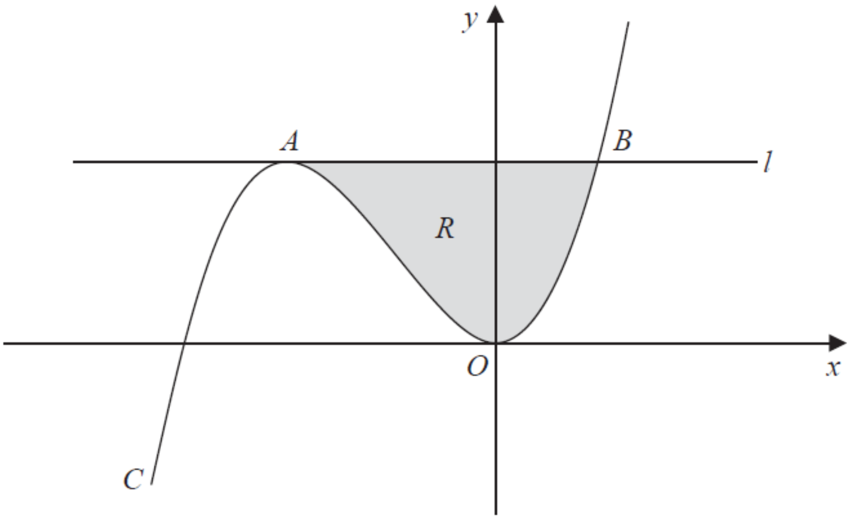


Figure 1

Figure 1 shows a sketch of part of the curve C with equation

$$y = \frac{1}{8}x^3 + \frac{3}{4}x^2, \qquad x \in \mathbb{R}$$

The curve C has a maximum turning point at the point A and a minimum turning point at the origin O.

The line l touches the curve C at the point A and cuts the curve C at the point B.

The x coordinate of A is –4 and the x coordinate of B is 2.

The finite region R, shown shaded in Figure 3, is bounded by the curve C and the line l.

Use integration to find the area of the finite region R.

(Total 7 marks)

6*. $$\frac{dy}{dx} = 6x^{-\frac{1}{2}} + x\sqrt{x}, \qquad x > 0$$

Given that $y = 37$ at $x = 4$, find y in terms of x, giving each term in its simplest form.

(Total 7 marks)

7*. A curve with equation $y = f(x)$ passes through the point (2, 10). Given that

$$f'(x) = 3x^2 - 3x + 5,$$

find the value of f(1).

(Total 5 marks)

8*. A curve with equation $y = f(x)$ passes through the point (4, 25).

Given that $f'(x) = \frac{3}{8}x^2 - 10x^{-\frac{1}{2}} + 1, \quad x > 0,$

(a) find $f(x)$, simplifying each term.

(5)

(b) Find an equation of the normal to the curve at the point (4, 25). Give your answer in the form $ax + by + c = 0$, where a, b and c are integers to be found.

(5)

(Total 10 marks)

9*. The curve C has equation $y = \mathrm{f}(x)$, $x > 0$, where

$$\mathrm{f}'(x) = 30 + \frac{6 - 5x^2}{\sqrt{x}}$$

Given that the point $P(4, –8)$ lies on C,

(a) find the equation of the tangent to C at P, giving your answer in the form $y = mx + c$, where m and c are constants.

(4)

(b) Find $\mathrm{f}(x)$, giving each term in its simplest form.

(5)

(Total 9 marks)

10*. A curve with equation $y = \mathrm{f}(x)$ passes through the point (4, 9).

Given that

$$\mathrm{f}'(x) = \frac{3\sqrt{x}}{2} - \frac{9}{4\sqrt{x}} + 2, \quad x > 0,$$

(a) find $\mathrm{f}(x)$, giving each term in its simplest form.

(5)

Point P lies on the curve.

The normal to the curve at P is parallel to the line $2y + x = 0$.

(b) Find the x-coordinate of P.

(5)

(Total 10 marks)

11.

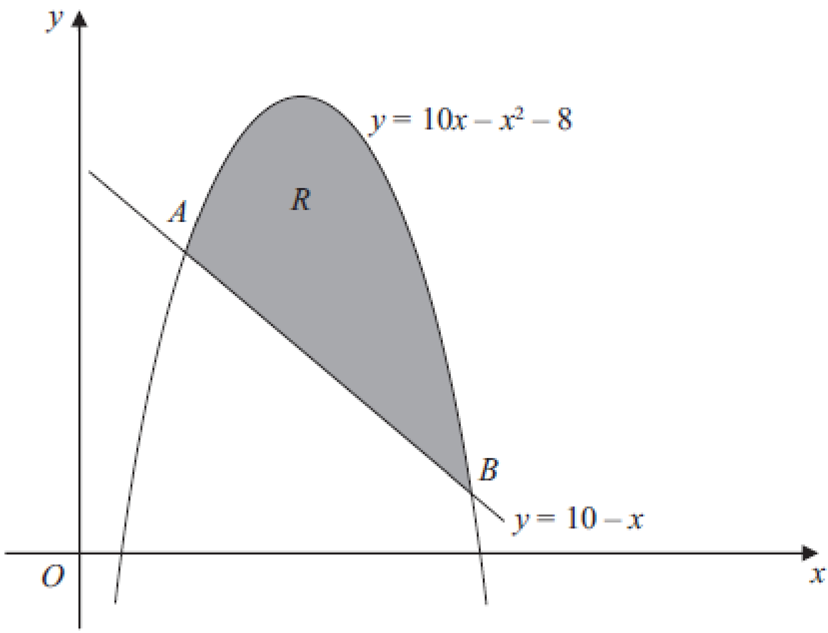


Figure 2

Figure 2 shows the line with equation $y = 10 - x$ and the curve with equation $y = 10x - x^2 - 8$.

The line and the curve intersect at the points A and B, and O is the origin.

(a) Calculate the coordinates of A and the coordinates of B.

(5)

The shaded area R is bounded by the line and the curve, as shown in Figure 2.

(b) Calculate the exact area of R.

(7)

(Total 12 marks)

12. (a) Find

$$\int 10x(x^{\frac{1}{2}} - 2) \ \ \mathrm{d}x \,,$$

giving each term in its simplest form.

(4)

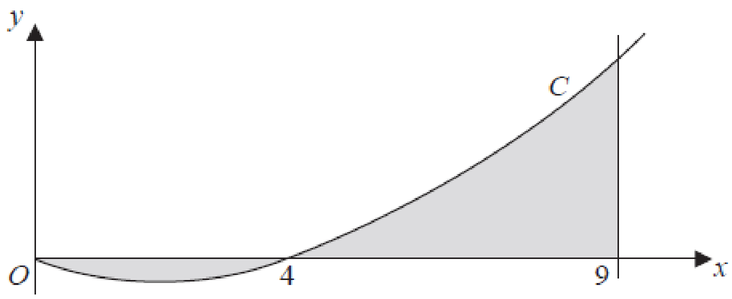


Figure 2

Figure 2 shows a sketch of part of the curve C with equation

$$y = 10x(x^{\frac{1}{2}} - 2), \qquad x \geq 0.$$

The curve C starts at the origin and crosses the x-axis at the point (4, 0).

The area, shown shaded in Figure 2, consists of two finite regions and is bounded by the curve C, the x-axis and the line $x = 9$.

(b) Use your answer from part (*a*) to find the total area of the shaded regions.

(5)

(Total 9 marks)

13.

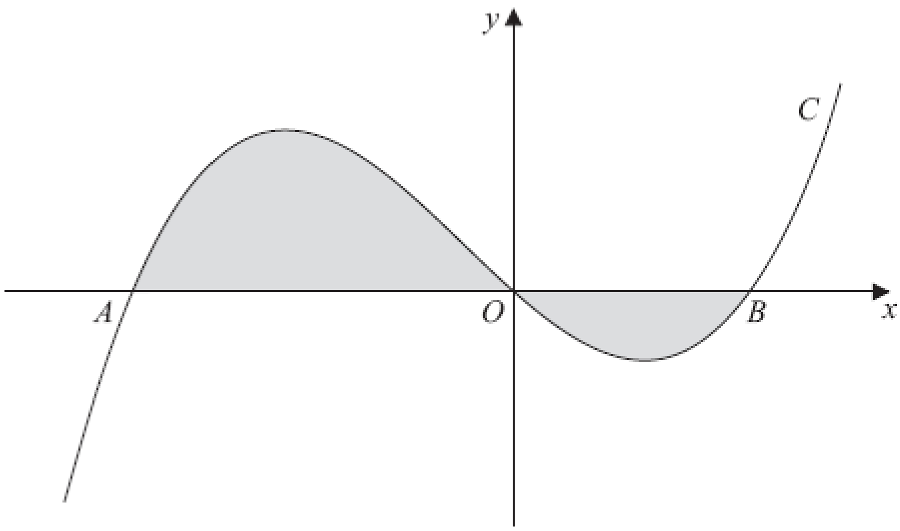


Figure 3

Figure 3 shows a sketch of part of the curve C with equation

$$y = x(x + 4)(x - 2).$$

The curve C crosses the x-axis at the origin O and at the points A and B.

(a) Write down the x-coordinates of the points A and B.

(1)

The finite region, shown shaded in Figure 3, is bounded by the curve C and the x-axis.

(b) Use integration to find the total area of the finite region shown shaded in Figure 3.

(7)

(Total 8 marks)

14.

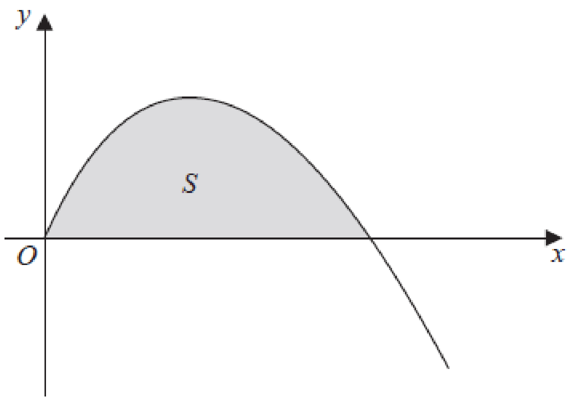


Figure 3

Figure 3 shows a sketch of part of the curve with equation

$$y = 3x - x^{\frac{3}{2}} \quad x \geq 0 .$$

The finite region S, bounded by the x-axis and the curve, is shown shaded in Figure 3.

(a) Find

$$\int \left(3x - x^{\frac{3}{2}} \right) \mathrm{d}x .$$

(3)

(b) Hence find the area of S.

(3)

(Total 6 marks)

TOTAL FOR PAPER: 100 MARKS

AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number

Candidate Number

AS and A level Mathematics

Practice Paper
Pure Mathematics - Trigonometry

You must have:
Mathematical Formulae and Statistical Tables (Pink)

Total Marks

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all the questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 6 questions in this question paper. The total mark for this paper is 49.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

1. Solve, for $0 \leq x < 180°$

$$\cos(3x - 10°) = -0.4$$

giving your answers to 1 decimal place. You should show each step in your working.

(Total 7 marks)

---

2. (a) Show that the equation

$$\cos^2 x = 8\sin^2 x - 6\sin x$$

can be written in the form

$$(3\sin x - 1)^2 = 2$$

(3)

(b) Hence solve, for $0 \leqslant x < 360°$,

$$\cos^2 x = 8\sin^2 x - 6\sin x$$

giving your answers to 2 decimal places.

(5)

(Total 8 marks)

---

3. (a) Show that the equation

$$\tan 2x = 5 \sin 2x$$

can be written in the form

$$(1 - 5\cos 2x)\sin 2x = 0$$

(2)

(b) Hence solve, for $0 \leq x \leq 180°$

$$\tan 2x = 5 \sin 2x$$

giving your answers to 1 decimal place where appropriate.

You must show clearly how you obtained your answers.

(5)

(Total 7 marks)

---

4. (a) Show that the equation

$$3 \sin^2 x + 7 \sin x = \cos^2 x - 4$$

can be written in the form

$$4 \sin^2 x + 7 \sin x + 3 = 0$$

(2)

(b) Hence solve, for $0 \leq x < 360°$

$$3 \sin^2 x + 7 \sin x = \cos^2 x - 4$$

giving your answers to 1 decimal place where appropriate.

(5)

(Total 7 marks)

---

5. (i) Solve, for $0 \leq \theta < 360°$, the equation $9 \sin (\theta + 60°) = 4$, giving your answers to 1 decimal place. You must show each step of your working.

(4)

(ii) Solve, for $-\pi \leq x < \pi$, the equation $2 \tan x - 3 \sin x = 0$, giving your answers to 2 decimal places where appropriate.

[*Solutions based entirely on graphical or numerical methods are not acceptable.*]

(5)

(Total 11 marks)

---

6. (i) Solve, for $-180° \le x < 180°$,

$$\tan(x - 40°) = 1.5,$$

giving your answers to 1 decimal place.

(3)

(ii) (*a*) Show that the equation

$$\sin\theta \tan\theta = 3\cos\theta + 2$$

can be written in the form

$$4\cos^2\theta + 2\cos\theta - 1 = 0.$$

(3)

(b) Hence solve, for $0 \le \theta < 360°$,

$$\sin\theta \tan\theta = 3\cos\theta + 2,$$

showing each stage of your working.

(5)

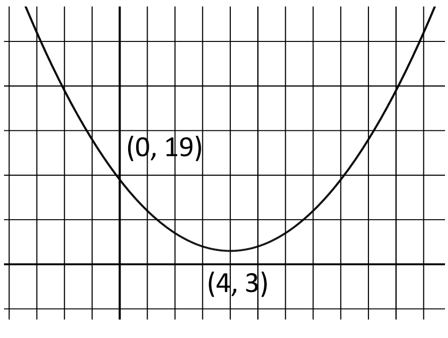
(Total 11 marks)

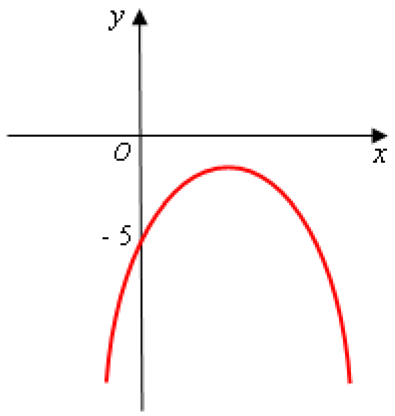
TOTAL FOR PAPER: 49 MARKS

AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

Question	Scheme	Marks
1	$\left\{\dfrac{2}{\sqrt{12}-\sqrt{8}}\right\} = \dfrac{2}{\left(\sqrt{12}-\sqrt{8}\right)} \times \dfrac{\left(\sqrt{12}+\sqrt{8}\right)}{\left(\sqrt{12}+\sqrt{8}\right)}$ Writing this is sufficient for M1	M1
	$= \dfrac{\left\{2\left(\sqrt{12}+\sqrt{8}\right)\right\}}{12-8}$ For $12-8$ This mark can be implied	A1
	$= \dfrac{2\left(2\sqrt{3}+2\sqrt{2}\right)}{12-8}$	B1 B1
	$= \sqrt{3}+\sqrt{2}$	A1 **cso**
		(5 marks)
2(a)	$\sqrt{50}-\sqrt{18} = 5\sqrt{2}-3\sqrt{2}$	M1
	$= 2\sqrt{2}$	A1
		(2)
2(b)	$\dfrac{12\sqrt{3}}{\sqrt{50}-\sqrt{18}} = \dfrac{12\sqrt{3}}{"2"\sqrt{2}}$	M1
	$= \dfrac{12\sqrt{3}}{"2"\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}} = \dfrac{12\sqrt{6}}{4}$	dM1
	$= 3\sqrt{6}$ or $b = 3$, $c = 6$	A1
		(3)
		(5 marks)
3(a)	$32^{\frac{1}{5}} = 2$	B1
		(1)
3(b)	For 2^{-2} or $\dfrac{1}{4}$ or $\left(\dfrac{1}{2}\right)^2$ or 0.25 as coefficient of x^k, for any value of k including $k = 0$	M1
	Correct index for x so $A\,x^{-2}$ or $\dfrac{A}{x^2}$ o.e. for any value of A	B1
	$= \dfrac{1}{4x^2}$ or $0.25\,x^{-2}$	A1 cao
		(3)
		(4 marks)

Question	Scheme	Marks
4(a)	$81^{\frac{3}{2}} = (81^{\frac{1}{2}})^3 = 9^3$ or $81^{\frac{3}{2}} = (81^3)^{\frac{1}{2}} = (531441)^{\frac{1}{2}}$	M1
	=729	A1
		(2)
4(b)	$(4x^{-\frac{1}{2}})^2 = 16x^{-\frac{2}{2}}$ or $\frac{16}{x}$ or equivalent	M1
	$x^2(4x^{-\frac{1}{2}})^2 = 16x$	A1
		(2)
		(4 marks)
5(a)	$16^{-\frac{1}{4}} = 2$ or $\frac{1}{16^{-\frac{1}{4}}}$ or better	M1
	$\left(16^{-\frac{1}{4}} =\right) \frac{1}{2}$ or 0.5 (ignore ±)	A1
		(2)
5(b)	$\left(2x^{-\frac{1}{4}}\right)^4 = 2^4 x^{-\frac{4}{4}}$ or $\frac{2^4}{x^{-\frac{4}{4}}}$ or equivalent	M1
	$x\left(2x^{-\frac{1}{4}}\right)^4 = 2^4$ or 16	A1 cao
		(2)
		(4 marks)
6(a)	$\left\{(32)^{\frac{3}{5}}\right\} = \left(\sqrt[5]{32}\right)^3$ or $\sqrt[5]{(32)^3}$ or 2^3 or $\sqrt[5]{32768}$	M1
	$= 8$	A1
		(2)
6(b)	$\left\{\left(\frac{25x^4}{4}\right)^{-\frac{1}{2}}\right\} = \left(\frac{4}{25x^4}\right)^{\frac{1}{2}}$ or $\left(\frac{5x^2}{2}\right)^{-1}$ or $\frac{1}{\left(\frac{25x^4}{4}\right)^{\frac{1}{2}}}$	M1
	$= \frac{2}{5x^2}$ or $\frac{2}{5}x^{-2}$	A1
		(2)
		(4 marks)

Question	Scheme	Marks
7(a)	$8^{\frac{1}{3}} = 2$ or $8^5 = 32768$ $\left(8^{\frac{5}{3}} =\right)$ 32	M1 A1 cao **(2)**
7(b)	$\left(2x^{\frac{1}{2}}\right)^3 = 2^3 x^{\frac{3}{2}}$ $\dfrac{8x^{\frac{3}{2}}}{4x^2} = 2x^{-\frac{1}{2}}$ or $\dfrac{2}{\sqrt{x}}$	M1 dM1A1 **(3)**
8	$(8^{2x+3} = \left(2^3\right)^{2x+3}) = 2^{3(2x+3)}$ or 2^{ax+b} with $a = 6$ **or** $b = 9$ $= 2^{6x+9}$ *or* $= 2^{3(2x+3)}$ as **final** answer with no errors or $(y =)6x + 9$ or $3(2x + 3)$	M1 A1
		(2 marks)
9	9^{3x+1} = for example $3^{2(3x+1)}$ or $\left(3^2\right)^{3x+1}$ or $\left(3^{(3x+1)}\right)^2$ or $3^{3x+1} \times 3^{3x+1}$ or $(3\times3)^{3x+1}$ or $3^2 \times \left(3^2\right)^{3x}$ or $\left(9^{\frac{1}{2}}\right)^y$ or $9^{\frac{1}{2}y}$ or $y = 2(3x+1)$ $= 3^{6x+2}$ or $y = 6x + 2$ or $a = 6$, $b = 2$	M1 A1
		(2 marks)
10(a)	$\mathrm{f}(x) = (x-4)^2 + 3$	M1A1 **(2)**
10(b)		B1 B1 B1 **(3)**
10(c)	$PQ^2 = (0-4)^2 + (19-3)^2$ $PQ = \sqrt{4^2 + 16^2}$ $PQ = 4\sqrt{17}$	M1 A1 A1 **(3)**

Question	Scheme	Marks
		(8 marks)
11(a)	Discriminant: $b^2 - 4ac = (k+3)^2 - 4k$ or equivalent	M1A1 **(2)**
11(b)	$(k+3)^2 - 4k = k^2 + 2k + 9 = (k+1)^2 + 8$	M1A1 **(2)**
11(c)	For real roots, $b^2 - 4ac \geq 0$ or $b^2 - 4ac > 0$ or $(k+1)^2 + 8 > 0$ $(k+1)^2 \geq 0$ for all *k*, so $b^2 - 4ac > 0$, so roots are real for all *k* (or equiv.)	M1 A1 cso **(2)**
		(6 marks)
12(a)	$4x - 5 - x^2 = q - (x-p)^2$, p, q are integers. $\{4x - 5 - x^2 =\}\ -[x^2 - 4x + 5] = -[(x-2)^2 - 4 + 5] = -[(x-2)^2 + 1]$ $= -1 - (x-2)^2$	M1 A1A1 **(3)**
12(b)	$\{"b^2 - 4ac" =\}\ 4^2 - 4(-1)(-5) \quad \{= 16 - 20\}$ $= -4$	M1 A1 **(2)**
12(c)	 Correct $\cap$ shape Maximum **within** the 4th quadrant Curve cuts through –5 or $(0, -5)$ marked on the *y*-axis	M1 A1 B1 **(3)**
		(8 marks)

AS and A level Mathematics Practice Paper – Algebra (part 1) – Mark scheme

Question	Scheme	Marks
13(a)	$\left(4^x =\right) y^2$ Allow y^2 or $y \times y$ or "*y* squared" $"4^x ="$ not required	B1 **(1)**
13(b)	$8y^2 - 9y + 1 = (8y-1)(y-1) = 0 \Rightarrow y = \ldots$ or $(8(2^x)-1)((2^x)-1) = 0 \Rightarrow 2^x = \ldots$ $2^x (\text{or } y) = \frac{1}{8},\ 1$ $x = -3 \quad x = 0$	M1 A1 M1A1 **(4)**
		(5 marks)
14	$x(1-4x^2)$ Accept $x(-4x^2+1)$ or $-x(4x^2-1)$ or $-x(-1+4x^2)$ or even $4x(\frac{1}{4}-x^2)$ or equivalent quadratic (or initial cubic) into two brackets $x(1-2x)(1+2x)$ or $-x(2x-1)(2x+1)$ or $x(2x-1)(-2x-1)$	B1 M1 A1
		(3 marks)
15	$25x - 9x^3 = x(25-9x^2)$ $(25-9x^2)$ =(5+3*x*)(5-3*x*) $25x - 9x^3 = x(5+3x)(5-3x)$	B1 M1 A1
		(3 marks)
16(a)	$f(-2) = 2.(-2)^3 - 7.(-2)^2 - 10.(-2) + 24$ = 0 so (*x*+2) is a factor	M1 A1 **(2)**
16(b)	$\mathrm{f}(x) = (x+2)(2x^2 - 11x + 12)$ $\mathrm{f}(x) = (x+2)(2x-3)(x-4)$	M1A1 dM1A1 **(4)**
		(6 marks)

Question	Scheme	Marks
17(a)	$\mathrm{f}(x) = 2x^3 - 7x^2 + 4x + 4$	
	$\mathrm{f}(2) = 2(2)^3 - 7(2)^2 + 4(2) + 4$	M1
	$= 0$, and so $(x - 2)$ is a factor.	A1
		(2)
17(b)	$\mathrm{f}(x) = \{(x - 2)\}(2x^2 - 3x - 2)$	M1A1
	$= (x-2)(x-2)(2x+1)$ or $(x-2)^2(2x+1)$	
	or equivalent e.g.	**d**M1A1
	$= 2(x-2)(x-2)(x+\frac{1}{2})$ or $2(x-2)^2(x+\frac{1}{2})$	
		(4)
		(6 marks)

EDEXCEL CORE MATHEMATICS C1 (6663) – MAY 2017 FINAL MARK SCHEME

	Source paper	Question number	New spec references	Question description
1	C1 2012	3	2.2	Indices and surds
2	C1 2016	3	2.2	Manipulation of surds
3	C1 2014	2	2.1	Laws of indices for rational exponents
4	C1 June 2014R	2	2.1	Laws of indices
5	C1 Jan 2011	1	2.1	Indices and surds
6	C1 2012	2	2.1	Indices and surds
7	C1 2013	3	2.1	Laws of Indices for all rational components
8	C1 Jan 2013	2	2.1	Indices and surds
9	C1 2016	2	2.1	Laws of indices for rational exponents
10	C1 2017	5	2.3	Completing the square, graph
11	C1 2011	7	2.3	Quadratics
12	C1 2012	8	2.3	Quadratics
13	C1 2015	7	2.1 and 2.3	Laws of indices, solution of quadratic equations
14	C1 Jan 2013	1	2.6	Polynomials, Factor theorem
15	C1 June 2014R	1	2.6	Cubic factorisation
16	C2 2012	4	2.6	Polynomials, Factor theorem
17	C2 2014	2	2.6	Polynomials, factor theorem

AS and A level Mathematics Practice Paper – Algebra (part 2) – Mark scheme

Question	Scheme		Marks
1	Either	Or	
	$y^2 = 4 - 4x + x^2$	$x^2 = 4 - 4y + y^2$	M1
	$4(4 - 4x + x^2) - x^2 = 11$ or $4(2-x)^2 - x^2 = 11$	$4y^2 - (4 - 4y + y^2) = 11$ or $4y^2 - (2-y)^2 = 11$	M1
	$3x^2 - 16x + 5 = 0$	$3y^2 + 4y - 15 = 0$ Correct 3 terms	A1
	$(3x-1)(x-5) = 0, \quad x = \ldots$	$(3y-5)(y+3) = 0, \quad y = \ldots$	M1
	$x = \frac{1}{3} \quad x = 5$	$y = \frac{5}{3} \quad y = -3$	A1
	$y = \frac{5}{3} \quad y = -3$	$x = \frac{1}{3} \quad x = 5$	M1A1
			(7 marks)
2	$y = 2x + 4 \Rightarrow 4x^2 + (2x+4)^2 + 20x = 0$ **or** $2x = y - 4$ or $x = \frac{y-4}{2}$ $\Rightarrow (y-4)^2 + y^2 + 10(y-4) = 0$		M1
	$8x^2 + 36x + 16 = 0$ or $2y^2 + 2y - 24 = 0$		M1 A1
	$(4)(2x+1)(x+4) = 0 \Rightarrow x = \ldots$ or $(2)(y+4)(y-3) = 0 \Rightarrow y = \ldots$		M1
	$x = -0.5, x = -4$ or $y = -4, y = 3$		A1 cso
	Sub into $y = 2x + 4$ or Sub into $x = \frac{y-4}{2}$		M1

AS and A level Mathematics Practice Paper – Algebra (part 2) – Mark scheme

Question	Scheme	Marks
	$y=3,\ y=-4$ and $x=-4,\ x=-0.5$	A1
		(7 marks)
3	$y=-4x-1$ $\Rightarrow(-4x-1)^2+5x^2+2x=0$ $21x^2+10x+1=0$ $(7x+1)(3x+1)=0\Rightarrow(x=)-\frac{1}{7},\ -\frac{1}{3}$ $y=-\dfrac{3}{7},\ \dfrac{1}{3}$	M1 A1 dM1 A1 M1 A1
		(6 marks)
4(a)	$x^2-4k(1-2x)+5k(=0)$ So $x^2+8kx+k=0$ *	M1 A1cso **(2)**
4(b)	$(8k)^2-4k$ $k=\dfrac{1}{16}$ (oe)	M1A1 A1 **(3)**
4(c)	$x^2+\frac{1}{2}x+\frac{1}{16}=0$ so $(x+\frac{1}{4})^2=0\Rightarrow x=$ $x=-\frac{1}{4},\ y=1\frac{1}{2}$	M1 A1A1 **(3)**
		(8 marks)
5(a)	$5x>20$ ***$x>4$***	M1 A1 **(2)**
5(b)	$x^2-4x-12=0$ $(x+2)(x-6)$ [= 0] $x=6,\ -2$ $x<-2\ ,\ x>6$	 M1 A1 M1A1ft **(4)**
		(6 marks)

AS and A level Mathematics Practice Paper – Algebra (part 2) – Mark scheme

Question	Scheme	Marks
6(a)	$6x + x > 1 - 8$ $x > -1$	M1 A1 **(2)**
6(b)	$(x + 3)(3x - 1)$ [= 0] $\Rightarrow x = -3$ and $\frac{1}{3}$ $-3 < x < \frac{1}{3}$	M1A1 M1A1ft **(4)**
		(6 marks)
7(a)	$3x - 7 > 3 - x$ $4x > 10$ $x > 2.5,\quad x > \frac{5}{2},\quad \frac{5}{2} < x\quad$ o.e.	 M1 A1 **(2)**
7(b)	Obtain $x^2 - 9x - 36$ and attempt to solve $x^2 - 9x - 36 = 0$ e.g. $(x-12)(x+3) = 0$ so $x =$, or $x = \frac{9 \pm \sqrt{81+144}}{2}$ 12, –3 $-3 \le x \le 12$	 M1 A1 M1A1 **(4)**
7(c)	$2.5 < x \le 12$	A1cso **(1)**
		(7 marks)
8(a)	$b^2 - 4ac = (k - 3)^2 - 4(3 - 2k)$ $k^2 - 6k + 9 - 4(3 - 2k) > 0$ or $(k - 3)^2 - 12 + 8k > 0$ or better $k^2 + 2k - 3 > 0$	M1 M1 A1 cso **(3)**
8(b)	$(k + 3)(k - 1)$ [= 0] Critical values are $k = 1$ or $k = -3$ (choosing "outside" region) $k > 1$ or $k < -3$	M1 A1 M1 A1 cao **(4)**
		(7 marks)

Question	Scheme	Marks
9(a)	**Method 1:** Attempts $b^2 - 4ac$ for $a = (k+3)$, $b = 6$ and their c $\quad c \neq k$	M1
	$b^2 - 4ac = 6^2 - 4(k+3)(k-5)$	A1
	$(b^2 - 4ac =) \quad -4k^2 + 8k + 96$ or $-(b^2 - 4ac =) \quad 4k^2 - 8k - 96$ (with no prior algebraic errors)	B1
	As $b^2 - 4ac > 0$, then $-4k^2 + 8k + 96 > 0$ and so, $k^2 - 2k - 24 < 0$	A1
	Method 2: Considers $b^2 > 4ac$ for $a = (k+3)$, $b = 6$ and their c $\quad c \neq k$	M1
	$6^2 > 4(k+3)(k-5)$	A1
	$4k^2 - 8k - 96 < 0$ or $-4k^2 + 8k + 96 > 0$ or $9 > (k+3)(k-5)$ (with no prior algebraic errors)	B1
	and so, $k^2 - 2k - 24 < 0$ following correct work	A1
		(4)
9(b)	Attempts to solve $k^2 - 2k - 24 = 0$ to give $k =$ ($\Rightarrow$ Critical values, $k = 6, -4$.)	M1
	$k^2 - 2k - 24 < 0$ gives $-4 < k < 6$	M1A1
		(3)
		(7 marks)
10(a)	$b^2 - 4ac < 0 \Rightarrow$ e.g.	M1
	$4^2 - 4(p-1)(p-5) < 0$ or $0 > 4^2 - 4(p-1)(p-5)$ or $4^2 < 4(p-1)(p-5)$ or $4(p-1)(p-5) > 4^2$	A1
	$4 < p^2 - 6p + 5$	
	$p^2 - 6p + 1 > 0$	A1*
		(3)
10(b)	$p^2 - 6p + 1 = 0 \Rightarrow p = \ldots$	M1
	$p = 3 \pm \sqrt{8}$	A1
	$p < 3 - \sqrt{8}$ or $p > 3 + \sqrt{8}$	M1A1
		(4)

Question	Scheme	Marks
		(7 marks)

AS and A level Mathematics Practice Paper – Algebra (part 2) – Mark scheme

Question	Scheme	Marks
11(a)	$2px^2-6px+4p\text{"}=\text{"}3x-7$ or $y=2p\left(\frac{y+7}{3}\right)^2-6p\left(\frac{y+7}{3}\right)+4p$	M1
	<u>**Examples**</u> $2px^2-6px+4p-3x+7(=0),\quad -2px^2+6px-4p+3x-7(=0)$ $2p\left(\frac{y+7}{3}\right)^2-6p\left(\frac{y+7}{3}\right)+4p-y(=0),\quad 2py^2+(10p-9)y+8p(=0)$ $y=2px^2-6px+4p-3x+7$	dM1
	E.g. $b^2-4ac=(-6p-3)^2-4(2p)(4p+7)$, $b^2-4ac=(10p-9)^2-4(2p)(8p)$	ddM1
	$4p^2-20p+9<0$ *	A1*
		(4)
11(b)	$(2p-9)(2p-1)=0\Rightarrow p=\ldots$ to obtain p =	M1
	$p=\frac{9}{2},\quad \frac{1}{2}$	A1
	$\frac{1}{2}<p<4\frac{1}{2}$	M1 A1
		(4)
		(8 marks)
12(a)	$P=20x+6$ o.e	B1
	$20x+6>40\Rightarrow x>$	M1
	$x>1.7$	A1*
		(3)
12(b)	Mark parts (b) and (c) together	
	$A=2x(2x+1)+2x(6x+3)=16x^2+8x$	B1
	$16x^2+8x-120<0$	M1
	Try to solve their $2x^2+x-15=0$ e.g. $(2x-5)(x+3)=0$ so x =	M1
	Choose inside region	M1
	$-3<x<\frac{5}{2}$ or $0<x<\frac{5}{2}$ (as x is a length)	A1
		(5)
12(c)	$1.7<x<\frac{5}{2}$	B1cao
		(1)
		(9 marks)

EDEXCEL CORE MATHEMATICS C1 (6663) – MAY 2017 FINAL MARK SCHEME

	Source paper	Question number	New spec references	Question description
1	C1 2011	4	2.4	Simultaneous equations
2	C1 2016	5	2.3 and 2.4	Simultaneous equations - one linear, one quadra
3	C1 2015	2	2.3 and 2.4	Solution of simultaneous equations
4	C1 2013	10	2.4	Simultaneous equations, one linear one quadrati
5	C1 Jan 2012	3	2.5	Inequalities
6	C1 2013	5	2.5	Inequalities
7	C1 2014	3	2.5	Solution of linear and quadratic inequalities
8	C1 Jan 2011	8	2.3 and 2.5	Quadratics, Inequalities, Polynomials, Factor theo
9	C1 Jan 2013	9	2.3 and 2.5	Quadratics, Inequalities
10	C1 2015	5	2.3 and 2.5	Discriminant, solution of inequality by formula
11	C1 2016	8	2.3, 2.4, 2.5, 2.6 and 2.7	Inequalities and discriminant
12	C1 June 2014R	6	2.5	Solution of linear and quadratic inequalities
1	C1 2011	4	2.4	Simultaneous equations
2	C1 2016	5	2.3 and 2.4	Simultaneous equations - one linear, one quadra

AS and A level Mathematics Practice Paper – Binomial expansion – Mark scheme

Question	Scheme	Marks
1	$\left[(2-3x)^5\right] = \ldots \quad + \binom{5}{1}2^4(-3x) + \binom{5}{2}2^3(-3x)^2 + \ldots, \quad \ldots\ldots$	M1
	$= 32, \ -240x, \ +720x^2$	B1 A1 A1
		(4 marks)
2	$\left(3-\frac{1}{3}x\right)^5$	
	$3^5 + {}^5C_1 3^4(-\frac{1}{3}x) + {}^5C_2 3^3(-\frac{1}{3}x)^2 + {}^5C_3 3^2(-\frac{1}{3}x)^3 \ldots$	
	First term of 243	B1
	$\left({}^5C_1 \times \ldots \times x\right) + \left({}^5C_2 \times \ldots \times x^2\right) + \left({}^5C_3 \times \ldots \times x^3\right) \ldots$	M1
	$= (243\,..)\ -\dfrac{405}{3}x + \dfrac{270}{9}x^2 - \dfrac{90}{27}x^3 \ldots$	A1
	$= (243\,..) - 135x + 30x^2 - \dfrac{10}{3}x^3 \ldots$	A1
		(4 marks)
3	$\left(2-\dfrac{x}{4}\right)^{10}$	
	$2^{10} + \underline{\underline{\binom{10}{1}}}2^9\left(-\dfrac{1}{4}\underline{\underline{x}}\right) + \underline{\underline{\binom{10}{2}}}2^8\left(-\dfrac{1}{4}\underline{\underline{x}}\right)^{\underline{\underline{2}}} + \ldots$	M1
	$= \underline{1024} - 1280x + 720x^2$	B1 A1 A1
		(4 marks)
4	$\left(1+\dfrac{3x}{2}\right)^8$	
	$1 + 12x$	B1
	$\ldots + \dfrac{8(7)}{2!}\left(\dfrac{3x}{2}\right)^2 + \dfrac{8(7)(6)}{3!}\left(\dfrac{3x}{2}\right)^3 + \ldots$	M1
	$\ldots + {}^8C_2\left(\dfrac{3x}{2}\right)^2 + {}^8C_3\left(\dfrac{3x}{2}\right)^3 + \ldots$	
	$\ldots + 63x^2 + 189x^3 + \ldots$	A1A1
		(4 marks)

Question	Scheme		Marks
5(a)	$\left\{(3+bx)^5\right\} = (3)^5 + \underline{{}^5C_1}(3)^4(b\underline{x}) + \underline{{}^5C_2}(3)^3(b\underline{x})^2 + \ldots$	243 as a constant term seen	B1
	$= 243 + 405bx + 270b^2x^2 + \ldots$	$405bx$	B1
		$\left({}^5C_1 \times \ldots \times x\right)$ or $\left({}^5C_2 \times \ldots \times x^2\right)$	M1
		$270b^2x^2$ or $270(bx)^2$	A1
			(4)
5(b)	$\left\{2(\text{coeff } x) = \text{coeff } x^2\right\} \Rightarrow 2(405b) = 270b^2$	Establishes an equation from their coefficients Condone 2 on the wrong side of the equation	M1
	So, $\left\{b = \frac{810}{270} \Rightarrow\right\}\ b = 3$	$b = 3$ (Ignore $b = 0$, if seen)	A1
			(2)
			(6 marks)
6(a)	$(1+\frac{x}{4})^8 = 1 + 2x + \ldots,\ \ldots\ldots$		B1
	$+\frac{8\times 7}{2}(\frac{x}{4})^2 + \frac{8\times 7\times 6}{2\times 3}(\frac{x}{4})^3,$		M1 A1
	$= \quad +\frac{7}{4}x^2 + \frac{7}{8}x^3$ or $= \quad +1.75x^2 + 0.875x^3$		A1
			(4)
6(b)	States or implies that $x = 0.1$		B1
	Substitutes their value of x (provided it is <1) into series obtained in (a)		M1
	i.e. 1 + 0.2 + 0.0175 + 0.000875, = 1.2184		A1 cao
			(3)
			(7 marks)

Question	Scheme	Marks
7(a)	$(2-3x)^6 = 64 + ...$ $\{(2-3x)^6\} = (2)^6 + \underline{{}^6C_1}(2)^5\underline{(-3x)} + \underline{{}^6C_2}(2)^4\underline{(-3x)^2} + ...$ $= 64 - 576x + 2160x^2 + ...$	B1 M1 A1A1 **(4)**
7(b)	$\left(1+\frac{x}{2}\right)(64-576x+\ ...)$ or $\left(1+\frac{x}{2}\right)(64-576x+2160x^2+...)$ or $\left(1+\frac{x}{2}\right)64-\left(1+\frac{x}{2}\right)576x$ or $\left(1+\frac{x}{2}\right)64-\left(1+\frac{x}{2}\right)576x+\left(1+\frac{x}{2}\right)2160x^2$ or $64+32x, -576x-288x^2,\ 2160x^2+1080x^3$ are fine. $= 64 - 544x + 1872x^2 + ...$	M1 A1A1 **(3)**
		(7 marks)
8(a)	$\binom{40}{4} = \frac{40!}{4!b!}$; $(1 + x)^n$ coefficients of x^4 and x^5 are p and q respectively $b = 36$ Candidates should usually "identify" two terms as their p and q respectively	B1 **(1)**
8(b)	Term 1: $\binom{40}{4}$ or ${}^{40}C_4$ or $\frac{40!}{4!36!}$ or $\frac{40(39)(38)(37)}{4!}$ or 91390 Term 2: $\binom{40}{5}$ or ${}^{40}C_5$ or $\frac{40!}{4!35!}$ or $\frac{40(39)(38)(37)(36)}{5!}$ or 658008 Hence, $\frac{q}{p} = \frac{658008}{91390}\left\{= \frac{36}{5} = 7.2\right\}$ Any one of Term 1 or Term 2 correct (Ignore the label of p and/or q) Both of them correct. (Ignore the label of p and/or q) $\frac{658008}{91390}$ oe	M1 A1 A1 oe cso **(3)**
		(4 marks)

Question	Scheme	Marks
9(a)	$(2-9x)^4 = 2^4 + {}^4C_1 2^3(-9x) + {}^4C_2 2^2(-9x)^2,$	
	(b) $\mathrm{f}(x) = (1+kx)(2-9x)^4 = A - 232x + Bx^2$	
	First term of 16 in their final series	B1
	At least one of $({}^4C_1 \times \ldots \times x)$ or $({}^4C_2 \times \ldots \times x^2)$	M1
	$= (16) - 288x + 1944x^2$	A1 A1
		(4)
9(b)	$A = \text{"16"}$	B1ft
		(1)
9(c)	$\{(1+kx)(2-9x)^4\} = (1+kx)(16 - 288x + \{1944x^2 + \ldots\})$	M1
	x terms: $-288x + 16kx = -232x$	
	giving, $16k = 56 \Rightarrow \underline{k = \frac{7}{2}}$	A1
		(2)
9(d)	x^2 terms: $1944x^2 - 288kx^2$	
	So, $B = 1944 - 288\left(\frac{7}{2}\right)$; $= 1944 - 1008 = 936$	M1 A1
		(2)
		(9 marks)

EDEXCEL CORE MATHEMATICS C1 (6663) – MAY 2017 FINAL MARK SCHEME

	Source paper	Question number	New spec references	Question description
1	C2 2012	1	4.1	Binomial expansion
2	C2 2017	1	4.1	Binomial expansion
3	C2 2015	1	4.1	Binomial expansion
4	C2 June 2014R	1	4.1	Binomial expansion
5	C2 2011	Q2	4.1	Binomial expansion
6	C2 Jan 2012	Q3	4.1	Binomial expansion
7	C2 2014	3	4.1	Binomial expansion
8	C2 Jan 2011	5	4.1	Binomial expansion
9	C2 2016	5	4.1	Binomial expansion

AS and A level Mathematics Practice Paper – Coordinate geometry – Mark scheme

Question	Scheme	Marks
1	Mid-point of PQ is (4, 3)	B1
	PQ: $m = \dfrac{0-6}{9-(-1)}$, $\left(= -\dfrac{3}{5}\right)$	B1
	Gradient perpendicular to PQ $= -\dfrac{1}{m}$ $\left(= \dfrac{5}{3}\right)$	M1
	$y - 3 = \dfrac{5}{3}(x-4)$	M1
	$5x - 3y - 11 = 0$ or $3y - 5x + 11 = 0$ or multiples e.g. $10x - 6y - 22 = 0$	A1
		(5 marks)
2(a)	Method: $1\ gradient = \dfrac{y_1 - y_2}{x_1 - x_2} = \dfrac{2-(-4)}{-1-7}, = -\dfrac{3}{4}$ Method 2: $\dfrac{y - y_1}{y_2 - y_1} = \dfrac{x - x_1}{x_2 - x_1}$, so $\dfrac{y - y_1}{6} = \dfrac{x - x_1}{-8}$	M1 A1
	$y - 2 = -\dfrac{3}{4}(x+1)$ or $y + 4 = -\dfrac{3}{4}(x-7)$ or $y = their\ '-\dfrac{3}{4}'x + c$	M1
	$\Rightarrow \pm(4y + 3x - 5) = 0$	A1
	Method 3: Substitute $x = -1$, $y = 2$ and $x = 7$, $y = -4$ into $ax + by + c = 0$	M1
	$-a + 2b + c = 0$ and $7a - 4b + c = 0$	A1
	Solve to obtain $a = 3$, $b = 4$ and $c = -5$ or multiple of these numbers	M1 A1
		(4)
2(b)	Attempts $gradient\ LM \times gradient\ MN = -1$ so $-\dfrac{3}{4} \times \dfrac{p+4}{16-7} = -1$ or $\dfrac{p+4}{16-7} = \dfrac{4}{3}$ Or $(y+4) = \dfrac{4}{3}(x-7)$ equation with x = 16 substituted	M1
	$p + 4 = \dfrac{9 \times 4}{3} \Rightarrow p = \ldots$, $p = 8$ So y =, $y = 8$	M1 A1
		(3)
2(c)	Either (y=) $p + 6$ or $2 + p + 4$ Or use 2 perpendicular line equations through L and N and solve for y	M1
	(y =) 14	A1
		(2)
		(9 marks)

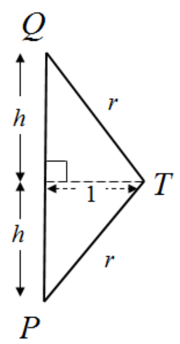
Question	Scheme	Marks
3(a)	Gradient of $l_1 = \frac{4}{5}$ oe	B1
	Point P = (5, 6)	B1
	$-\frac{5}{4} = \frac{y-"6"}{x-5}$ or $y-"6" = -\frac{5}{4}(x-5)$ or $"6" = -\frac{5}{4}(5)+c \Rightarrow c = \ldots$	M1
	5x + 4y – 49 = 0	A1
		(4)
3(b)	$y=0 \Rightarrow 5x+4(0)-49=0 \Rightarrow x=\ldots$ **or** $y=0 \Rightarrow 5(0)=4x+10 \Rightarrow x=\ldots$	M1
	$y=0 \Rightarrow 5x+4(0)-49=0 \Rightarrow x=\ldots$ **and** $y=0 \Rightarrow 5(0)=4x+10 \Rightarrow x=\ldots$	M1
	<u>**Method 1:**</u> $\frac{1}{2}ST \times "6"$ $\frac{1}{2}\times('9.8'-'-2.5')\times'6'=\ldots$ <u>**Method 2:**</u> $\frac{1}{2}SP\times PT$ $\frac{1}{2}\times\sqrt{(5-'-2.5')^2+('6')^2}\times\sqrt{('9.8'-5)^2+('6')^2}=\ldots$ $\left(=\frac{1}{2}\times\frac{3\sqrt{41}}{2}\times\frac{6\sqrt{41}}{5}\right)$ <u>**Method 3:**</u> 2 Triangles $\frac{1}{2}\times(5+'2.5')\times'6'+\frac{1}{2}\times('9.8'-5)\times'6'=\ldots$ <u>**Method 4:**</u> Shoelace method $\frac{1}{2}\begin{vmatrix}5 & 9.8 & -2.5 & 5\\ 6 & 0 & 0 & 6\end{vmatrix} = \frac{1}{2}\left\|(0+0-15)-(58.8+0+0)\right\| = \frac{1}{2}\left\|-73.8\right\| = \ldots$ <u>**Method 5:**</u> Trapezium + 2 triangles $\frac{1}{2}\times('2.5')\times'2'+\frac{1}{2}("2"+"6")\times5+\frac{1}{2}\times("9.8"-5')\times'6'=\ldots$	**dd**M1
	= 36.9	A1
		(4)
		(8 marks)

Question	Scheme	Marks
4(a)	(a) $2x+3y=26 \Rightarrow 3y=26\pm 2x$ and attempt to find *m* from *y* = *mx* + *c*	M1
	($\Rightarrow y=\frac{26}{3}-\frac{2}{3}x$) so gradient = $-\frac{2}{3}$	A1
	Gradient of perpendicular = $\frac{-1}{\text{their gradient}}$ (= $\frac{3}{2}$)	M1
	Line goes through (0,0) so $y=\frac{3}{2}x$	A1
		(4)
4(b)	(b) Solves their $y=\frac{3}{2}x$ with their $2x+3y=26$ to form equation in *x* or in *y*	M1
	Solves their equation in *x* or in *y* to obtain *x* = **or** *y* =	dM1
	x=4 or any equivalent e.g. 156/39 or *y* = 6 o.a.e	A1
	B= (0, $\frac{26}{3}$) used or stated in (b)	B1
	Area = $\frac{1}{2}\times"4"\times\frac{"26"}{3}$	dM1
	$=\frac{52}{3}$ (oe with integer numerator and denominator)	A1
		(6)
		(10 marks)

Question	Scheme		Marks
5(a)	$L_1: 4y+3=2x \Rightarrow y=\frac{1}{2}x-\frac{3}{4}$; $A(p, 4)$ lies on L_1.		
	$\{p=\}\ 9\frac{1}{2}$ or $\frac{19}{2}$ or 9.5		B1
			(1)
5(b)	$\{4y+3=2x\} \Rightarrow y=\frac{2x-3}{4} \Rightarrow m(L_1)=\frac{1}{2}$ or $\frac{2}{4}$		M1 A1
	So $m(L_2)=-2$		B1ft
	$L_2:\ y-4=-2(x-2)$		M1
	$L_2:\ 2x+y-8=0$ or $L_2:\ 2x+1y-8=0$		A1
			(5)
5(c)	$\{L_1=L_2 \Rightarrow\}\ 4(8-2x)+3=2x$ or $-2x+8=\frac{1}{2}x-\frac{3}{4}$		M1
	$x=3.5,\ y=1$		A1 A1 cso
			(3)
5(d)	$CD^2=("3.5"-2)^2+("1"-4)^2$		"M1"
	$CD=\sqrt{("3.5"-2)^2+("1"-4)^2}$		A1 ft
	$=\sqrt{1.5^2+3^2}=1.5\sqrt{1^2+2^2}=1.5\sqrt{5}$ or $\frac{3}{2}\sqrt{5}$ **(*)**		A1 **cso**
			(3)
5(e)	Area = triangle ABC + triangle ABE		
	$=\frac{1}{2}\times\frac{3}{2}\sqrt{5}\times\sqrt{80}+\frac{1}{2}\times3\sqrt{5}\times\sqrt{80}$	Finding the area of any triangle.	M1
	$=\frac{3}{4}\sqrt{5}\times4\sqrt{5}+\frac{3}{2}\sqrt{5}\times4\sqrt{5}$		
	$=\frac{3}{4}(20)+\frac{3}{2}(20)$		B1
	$=45$		A1
			(3)
			(15 marks)

Question	Scheme	Marks
6(a)	Gradient of l_1 is $\frac{7-2}{3-0}\left(=\frac{5}{3}\right)$	B1
	$m(l_2) = -1 \div their\ \frac{5}{3}$	M1
	$y-7 = "-\tfrac{3}{5}"(x-3)$ or $y = "-\tfrac{3}{5}"x + c,\ \ 7 = "-\tfrac{3}{5}"(3) + c \ \Rightarrow\ c = \tfrac{44}{5}$	M1A1ft
	$3x + 5y - 44 = 0$	A1
		(5)
6(b)	When $y = 0$ $x = \frac{44}{3}$	M1 A1
		(2)
6(c)	Correct attempt at finding the area of any one of the triangles or one of the trapezia.	M1
	A correct numerical **expression** for the area of one **triangle** or one **trapezium** for **their coordinates**.	A1ft
	Combines the correct areas together correctly	dM1
	Correct numerical expression for the area of *ORQP*	A1
	Correct exact area e.g. $54\tfrac{1}{3}$, $\frac{163}{3}$, $\frac{326}{6}$, $54.\dot{3}$ or any exact equivalent	A1
		(5)
		(12 marks)
7	The equation of the circle is $(x+1)^2 + (y-7)^2 = (r^2)$	M1 A1
	The radius of the circle is $\sqrt{(-1)^2 + 7^2} = \sqrt{50}$ or $5\sqrt{2}$ or $r^2 = 50$	M1
	So $(x+1)^2 + (y-7)^2 = 50$ or equivalent	A1
		(4 marks)

Question	Scheme	Marks
8(a)	$\{PQ=\}\ \sqrt{(7-10)^2+(8-13)^2}$ or $\sqrt{(10-7)^2+(13-8)^2}$	M1
	$\{PQ\} = \sqrt{34}$	A1
		(2)
8(b)	$(x-7)^2+(y-8)^2=34$ $\left(\text{or } \left(\sqrt{34}\right)^2\right)$	M1 A1 oe
		(2)
8(c)	$\{\text{Gradient of radius}\}=\frac{13-8}{10-7}$ or $\frac{5}{3}$	B1
	Gradient of tangent $=-\frac{1}{m}\left(=-\frac{3}{5}\right)$	M1
	$y-13=-\frac{3}{5}(x-10)$	M1
	$3x+5y-95=0$	A1
		(4)
		(8 marks)
9(a)	$x^2+y^2+4x-2y-11=0$	
	$\left\{\underline{(x+2)^2-4}+\underline{\underline{(y-1)^2-1}}-11=0\right\}$ $(\pm 2, \pm 1)$, see notes.	M1
	Centre is $(-2, 1)$. $(-2, 1)$.	A1 **cao**
		(2)
9(b)	$(x+2)^2+(y-1)^2=11+1+4$	
	So $r=\sqrt{11+1+4} \Rightarrow r=4$ $r=\sqrt{11\pm\text{"1"}\pm\text{"4"}}$	M1
	4 or $\sqrt{16}$ (Award A0 for ± 4).	A1
		(2)
9(c)	When $x=0$, $y^2-2y-11=0$ Putting $x=0$ in *C* or their *C*.	M1
	$y^2-2y-11=0$ or $(y-1)^2=12$, etc	A1 aef
	$y=\frac{2\pm\sqrt{(-2)^2-4(1)(-11)}}{2(1)}$ $\left\{=\frac{2\pm\sqrt{48}}{2}\right\}$ Attempt to use formula or a method of completing the square in order to find $y=\dots$	M1
	So, $y=1\pm 2\sqrt{3}$ $1\pm 2\sqrt{3}$	A1 **cao cso**
		(4)
		(8 marks)

Question	Scheme	Marks
10(a)	$x^2 + y^2 - 10x + 6y + 30 = 0$ Uses any appropriate method to find the coordinates of the centre, e.g. achieves $\underline{(x \pm 5)^2} + \underline{\underline{(y \pm 3)^2}} = \ldots$. Accept (±5,±3) as indication of this. Centre is $(5, -3)$.	M1 A1 **(2)**
10(b)	**Way 1** Uses $\underline{(x \pm "5")^2 - "5^2"} + \underline{\underline{(y \pm "3")^2 - "3^2"}} + 30 = 0$ to give $r = \sqrt{"25"+"9"-30}$ or $r^2 = "25"+"9"-30$ (not 30 – 25 – 9) *r* = 2 **Way 2** Using $\sqrt{g^2 + f^2 - c}$ from $x^2 + y^2 + 2gx + 2fy + c = 0$ (Needs formula stated or correct working) *r* = 2	M1 A1cao M1 A1 **(2)**
10(c)	**Way 1** Use *x* = 4 in *an* equation of circle and obtain equation in *y* only e.g. $(4-5)^2 + (y+3)^2 = 4$ or $4^2 + y^2 - 10\times 4 + 6y + 30 = 0$ Solve their quadratic in *y* and obtain **two** solutions for *y* e.g. $(y+3)^2 = 3$ or $y^2 + 6y + 6 = 0$ so $y = -3 \pm \sqrt{3}$ **Way 2**  Divide triangle *PTQ* and use Pythagoras with $"r"^2 - ("5"-4)^2 = h^2$ Find *h* and evaluate $"-3" \pm h$ May recognise (1,√3, 2) triangle So $y = -3 \pm \sqrt{3}$	M1 dM1 A1 M1 dM1 A1 **(3)**
		(7 marks)

Question	Scheme	Marks
11(a)	**Mark (a) and (b) together**	
	$OQ^2 = \left(6\sqrt{5}\right)^2 + 4^2$ or $OQ = \sqrt{\left(6\sqrt{5}\right)^2 + 4^2}$ $\{= 14\}$	M1
	$y_Q = \sqrt{14^2 - 11^2}$	**d**M1
	$= \sqrt{75}$ or $5\sqrt{3}$	A1**cso**
		(3)
11(b)	$(x-11)^2 + \left(y - 5\sqrt{3}\right)^2 = 16$	M1A1
		(2)
		(5 marks)
12(a)	$A\left(\frac{-9+15}{2}, \frac{8-10}{2}\right) = A(3, -1)$	M1A1
		(2)
12(b)	$(-9-3)^2 + (8+1)^2$ or $\sqrt{(-9-3)^2 + (8+1)^2}$ or $(15-3)^2 + (-10+1)^2$ or $\sqrt{(15-3)^2 + (-10+1)^2}$ Uses Pythagoras correctly in order to find the **radius**. Must clearly be identified as the **radius** and may be implied by their circle equation. Or $(15+9)^2 + (-10-8)^2$ or $\sqrt{(15+9)^2 + (-10-8)^2}$ Uses Pythagoras correctly in order to find the **diameter**. Must clearly be identified as the **diameter** and may be implied by their circle equation. This mark can be implied by just 30 clearly seen as the **diameter** or 15 clearly seen as the **radius** (may be seen or implied in their circle equation) **Allow this mark if there is a correct statement involving the radius or the diameter but <u>must be seen in (b)</u>**	M1
	$(x-3)^2 + (y+1)^2 = 225$ $\left(\text{or } (15)^2\right)$	M1
	$(x-3)^2 + (y+1)^2 = 225$	A1
		(3)
12(c)	Distance $= \sqrt{15^2 - 10^2}$	M1
	$\left\{= \sqrt{125}\right\} = 5\sqrt{5}$	A1
		(2)
12(d)	$\sin\left(ARQ\right) = \frac{20}{30}$ or $ARQ = 90 - \cos^{-1}\left(\frac{10}{15}\right)$	M1
	$ARQ = 41.8103...$ awrt 41.8	A1

Question	Scheme	Marks
		(2)
		(9 marks)

EDEXCEL CORE MATHEMATICS C1 (6663) – MAY 2017 FINAL MARK SCHEME

	Source paper	Question number	New spec references	Question description
1	C1 2011	3	3.1	Straight lines
2	C1 2017	8	3.1	Straight-line graph (perpendicular gradients)
3	C1 June 2014R	7	3.1	Equation of straight line and condition for perpendiculari
4	C1 2014	9	3.1	Coordinate geometry, perpendicularity
5	C1 2012	9	3.1, 2.4	Straight lines, Indices and surds, Simultaneous equations
6	C1 2016	10	3.1	Lines, perpendicular
7	C2 Jan 2012	Q2	3.2	Circles
8	C2 2016	3	3.1, 3.2	Circles
9	C2 2011	Q4	2.3, 3.2	Circles
10	C2 2017	5	3.2	Circles
11	C2 2014	9	3.2	Circles
12	C2 June 2014R	10	3.2	Circles

AS and A level Mathematics Practice Paper – Differentiation (part 2) – Mark scheme

Question	Scheme	Marks
1	$y=\sqrt{x}+\dfrac{4}{\sqrt{x}}+4=x^{\frac{1}{2}}+4x^{-\frac{1}{2}}+4$	
	$x^n \to x^{n-1}$	M1
	$\left(\dfrac{dy}{dx}=\right)\dfrac{1}{2}x^{-\frac{1}{2}}+4\times-\dfrac{1}{2}x^{-\frac{3}{2}}$ $\left(=\dfrac{1}{2}x^{-\frac{1}{2}}-2x^{-\frac{3}{2}}\right)$	A1
	$x=8\Rightarrow\dfrac{dy}{dx}=\dfrac{1}{2}8^{-\frac{1}{2}}+4\times-\dfrac{1}{2}8^{-\frac{3}{2}}$	M1
	$=\dfrac{1}{2\sqrt{8}}-\dfrac{2}{\left(\sqrt{8}\right)^3}=\dfrac{1}{2\sqrt{8}}-\dfrac{2}{8\sqrt{8}}=\dfrac{1}{8\sqrt{2}}=\dfrac{1}{16}\sqrt{2}$	B1 A1
		(5 marks)
2	$\dfrac{2x^3-7}{3\sqrt{x}}=\dfrac{2x^3}{3\sqrt{x}}-\dfrac{7}{3\sqrt{x}}=\dfrac{2}{3}x^{\frac{5}{2}}-\dfrac{7}{3}x^{-\frac{1}{2}}$	M1
	$x^n \to x^{n-1}$	M1
	$\left(\dfrac{dy}{dx}=\right)\ 6x+2x^{-\frac{2}{3}}+\dfrac{5}{3}x^{\frac{3}{2}}+\dfrac{7}{6}x^{-\frac{3}{2}}$	A1A1 A1A1
		(6 marks)
3	(b) $\dfrac{x^5+6\sqrt{x}}{2x^2}=\dfrac{x^5}{2x^2}+6\dfrac{\sqrt{x}}{2x^2},=\dfrac{1}{2}x^3+3x^{-\frac{3}{2}}$	M1 A1
	Attempts to differentiate $x^{-\frac{3}{2}}$ to give $k\ x^{-\frac{5}{2}}$	M1
	$=\dfrac{3}{2}x^2-\dfrac{9}{2}x^{-\frac{5}{2}}$ o.e.	A1
		(4 marks)

AS and A level Mathematics Practice Paper – Differentiation (part 2) – Mark scheme

Question	Scheme	Marks
4(a)	$y = 5x^3 - 6x^{\frac{4}{3}} + 2x - 3$	
	$\left\{\frac{dy}{dx} =\right\}\ 5(3)x^2 - 6\left(\frac{4}{3}\right)x^{\frac{1}{3}} + 2$	M1
	$= 15x^2 - 8x^{\frac{1}{3}} + 2$	A1 A1 A1
		(4)
4(b)	$\left\{\frac{d^2y}{dx^2} =\right\}\ 30x - \frac{8}{3}x^{-\frac{2}{3}}$	M1 A1
		(2)
		(6 marks)

AS and A level Mathematics Practice Paper – Differentiation (part 2) – Mark scheme

<table>
<tr><th>Question</th><th>Scheme</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>$(h =)\dfrac{60}{\pi x^2}$ or equivalent exact (not decimal) expression e.g. $(h =)60 \div \pi x^2$</td><td>B1

(1)</td></tr>
<tr><td>5(b)</td><td>$(A =)2\pi x^2 + 2\pi xh$ or $(A =)2\pi r^2 + 2\pi rh$ or $(A =)2\pi r^2 + \pi dh$
may not be simplified and may appear on separate lines
Either $(A) = 2\pi x^2 + 2\pi x\left(\dfrac{60}{\pi x^2}\right)$ or As $\pi xh = \dfrac{60}{x}$
then $(A =)2\pi x^2 + 2\left(\dfrac{60}{x}\right)$
$A = 2\pi x^2 + \left(\dfrac{120}{x}\right)$</td><td>B1

M1

A1 cso

(3)</td></tr>
<tr><td>5(c)</td><td>$\left(\dfrac{\mathrm{d}A}{\mathrm{d}x}\right) = 4\pi x - \dfrac{120}{x^2}$ or $= 4\pi x - 120x^{-2}$
$4\pi x - \dfrac{120}{x^2} = 0$ implies $x^3 =$ (Use of > 0 or < 0 is M0 then M0A0)
$x = \sqrt[3]{\dfrac{120}{4\pi}}$ or answers which round to 2.12 (−2.12 is A0)</td><td>M1 A1

M1

dM1 A1

(5)</td></tr>
<tr><td>5(d)</td><td>$A = 2\pi(2.12)^2 + \dfrac{120}{2.12}$, = 85 (only ft x = 2 or 2.1 – both give 85)</td><td>M1 A1

(2)</td></tr>
<tr><td>5(e)</td><td>Either $\dfrac{d^2A}{dx^2} = 4\pi + \dfrac{240}{x^3}$ and sign considered (May appear in (c))
Or (method 2) considers gradient to left and right of their 2.12 (e.g. at 2 and 2.5)
Or (method 3) considers value of A either side

which is > 0 and therefore minimum (most substitute 2.12 but it is not essential to see a substitution) (may appear in (c))
Finds numerical values for gradients and observes gradients go from negative to zero to positive so concludes minimum
OR finds numerical values of A , observing greater than minimum value and draws conclusion</td><td>M1

A1

(2)</td></tr>
<tr><td></td><td></td><td>(13 marks)</td></tr>
</table>

AS and A level Mathematics Practice Paper – Differentiation (part 2) – Mark scheme

Question	Scheme	Marks
6(a)	Either: (Cost of polishing top and bottom (two circles) is) $3\times 2\pi r^2$ **or (**Cost of polishing curved surface area is) $2\times 2\pi rh$ or both - just need to see at least one of these products	B1
	Uses volume to give $(h=)\dfrac{75\pi}{\pi r^2}$ or $(h=)\dfrac{75}{r^2}$ (simplified) (if *V* is misread – see below)	B1ft
	$(C)=6\pi r^2+4\pi r\left(\dfrac{75}{r^2}\right)$ Substitutes expression for *h* into area or cost expression of form Ar^2+Brh	M1
	$C=6\pi r^2+\dfrac{300\pi}{r}$ *	A1*
		(4)
6(b)	$\left\{\dfrac{dC}{dr}=\right\}12\pi r-\dfrac{300\pi}{r^2}$ or $12\pi r-300\pi r^{-2}$ (then isw).	M1 A1 ft
	$12\pi r-\dfrac{300\pi}{r^2}=0$ **so** $r^k=\text{value}$ where $k=\pm 2,\pm 3,\pm 4$	dM1
	Use **cube** root to obtain *r* = *their* $\left(\dfrac{300}{12}\right)^{\frac{1}{3}}$ (= 2.92) allow *r* = 3, and thus *C* =	ddM1
	Then *C* = awrt 483 or 484	A1cao
		(5)
6(c)	$\left\{\dfrac{d^2C}{dr^2}=\right\}12\pi+\dfrac{600\pi}{r^3}>0$ **so minimum**	B1ft
		(1)
		(10 marks)

AS and A level Mathematics Practice Paper – Differentiation (part 2) – Mark scheme

Question	Scheme	Marks
7(a)	$kr^2 + cxy = 4$ or $kr^2 + c[(x+y)^2 - x^2 - y^2] = 4$	M1
	$\frac{1}{4}\pi x^2 + 2xy = 4$	A1
	$y = \dfrac{4 - \frac{1}{4}\pi x^2}{2x} = \dfrac{16 - \pi x^2}{8x}$ *	B1 cso
		(3)
7(b)	$P = 2x + cy + k\pi r$ where $c = 2$ or 4 and $k = ¼$ or $½$	M1
	$P = \dfrac{\pi x}{2} + 2x + 4\left(\dfrac{4 - \frac{1}{4}\pi x^2}{2x}\right)$ or $P = \dfrac{\pi x}{2} + 2x + 4\left(\dfrac{16 - \pi x^2}{8x}\right)$ o.e.	A1
	$P = \dfrac{\pi x}{2} + 2x + \dfrac{8}{x} - \dfrac{\pi x}{2}$ so $P = \dfrac{8}{x} + 2x$ *	A1
		(3)
7(c)	$\left(\dfrac{dP}{dx} =\right) - \dfrac{8}{x^2} + 2$	M1 A1
	$-\dfrac{8}{x^2} + 2 = 0 \Rightarrow x^2 = ..$	M1
	and so $x = 2$ o.e. (ignore extra answer $x = -2$)	A1
	$P = 4 + 4 = 8$ (m)	B1
		(5)
7(d)	$y = \dfrac{4 - \pi}{4}$, (and so width) = 21 (cm)	M1 A1
		(2)
		(13 marks)

AS and A level Mathematics Practice Paper – Differentiation (part 2) – Mark scheme

Question	Scheme	Marks
8(a)	$\{A=\}\ xy+\frac{\pi}{2}\left(\frac{x}{2}\right)^2+\frac{1}{2}x^2\sin 60^\circ$	M1A1
	$50= xy+\frac{\pi x^2}{8}+\frac{\sqrt{3}x^2}{4} \Rightarrow y=\frac{50}{x}-\frac{\pi x}{8}-\frac{\sqrt{3}x}{4} \Rightarrow \underline{y=\frac{50}{x}-\frac{x}{8}\left(\pi+2\sqrt{3}\right)}$ *	A1 *
		(3)
8(b)	$\{P=\}\ \frac{\pi x}{2}+2x+2y$	B1
	$P=\frac{\pi x}{2}+2x+2\left(\frac{50}{x}-\frac{x}{8}\left(\pi+2\sqrt{3}\right)\right)$	M1
	$P=\frac{\pi x}{2}+2x+\frac{100}{x}-\frac{\pi x}{4}-\frac{\sqrt{3}}{2}x \Rightarrow P=\frac{100}{x}+\frac{\pi x}{4}+2x-\frac{\sqrt{3}}{2}x$	
	$\Rightarrow \underline{P=\frac{100}{x}+\frac{x}{4}\left(\pi+8-2\sqrt{3}\right)}$	A1 *
		(3)
8(c)	$\frac{\mathrm{d}P}{\mathrm{d}x}=-100x^{-2}+\frac{\pi+8-2\sqrt{3}}{4}$	M1A1
	$-100x^{-2}+\frac{\pi+8-2\sqrt{3}}{4}=0 \Rightarrow x=\ldots$	M1
	$\Rightarrow x=\sqrt{\frac{400}{\pi+8-2\sqrt{3}}}=7.2180574\ldots$	A1
	$\{x=7.218\ldots,\} \Rightarrow P=27.708\ldots\ (\mathrm{m})$ awrt 27.7	A1
		(5)
8(d)	$\frac{\mathrm{d}^2P}{\mathrm{d}x^2}=\frac{200}{x^3}>0 \Rightarrow \text{Minimum}$	M1A1ft
	Note: parts(c) and (d) can be marked together	
		(2)
		(13 marks)

Question	Scheme	Marks
9(a)	$V = 4x(5 - x)^2$ So, $V = 100x - 4x^2 + 4x^3$ $\dfrac{dV}{dx} = 100 - 80x + 12x^2$	
	$\pm \alpha x \pm \beta x^2 \pm \gamma x^3$, $\alpha, \beta, \gamma \neq 0$	M1
	$V = 100x - 4x^2 + 4x^3$	A1
	At least two of their expanded terms differentiated correctly	M1
	$100 - 80x + 12x^2$	A1 cao
		(4)
9(b)	$100 - 80x + 12x^2 = 0$ $\{\Rightarrow 4(3x^2 - 20x + 25) = 0 \Rightarrow 4(3x - 5)(x - 5) = 0\}$ {As $0 < x < 5$} $x = \dfrac{5}{3}$ $x = \dfrac{5}{3}$, $V = 4(\dfrac{5}{3})(5 - \dfrac{5}{3})^2$ So, $V = \dfrac{2000}{27} = 74\dfrac{2}{27} = 74.074...$	
	Sets their $\dfrac{dV}{dx}$ from part (a) = 0	M1
	$x = \dfrac{5}{3}$ or x = awrt 1.67	A1
	Substitute candidate's value of x **where** $0 < x < 5$ into a formula for V	dM1
	Either $\dfrac{2000}{27}$ or $74\dfrac{2}{27}$ or awrt 74.1	A1
		(4)
9(c)	$\dfrac{d^2V}{dx^2} = -80 + 24x$ When $x = \dfrac{5}{3}$, $\dfrac{d^2V}{dx^2} = -80 + 24(\dfrac{5}{3})$ $\dfrac{d^2V}{dx^2} = -40 < 0 \Rightarrow V$ ia a maximum	
	Differentiates their $\dfrac{dV}{dx}$ **correctly** to give $\dfrac{d^2V}{dx^2}$	M1
	$\underline{\dfrac{d^2V}{dx^2} = -40}$ and $\underline{< 0 \text{ or negative}}$ and $\underline{\text{maximum}}$	A1 cso
		(2)
		(10 marks)

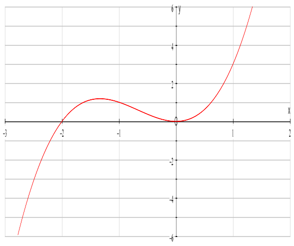
Question	Scheme	Marks
10(a)	$\vartheta = 20 + Ae^{-kt}$ (eqn *) $\{t = 0, \vartheta = 90 \Rightarrow\}\ 90 = 20 + Ae^{-k(0)}$ $90 = 20 + A \Rightarrow A = 70$	
	Substitutes $t = 0$ and $\vartheta = 90$ into eqn *	M1
	$\underline{A = 70}$	A1
		(2)
10(b)	$\vartheta = 20 + 70e^{-kt}$ $\{t = 5, \vartheta = 55 \Rightarrow\}\ 55 = 20 + Ae^{-k(5)}$ $\frac{35}{70} = e^{-5k}$ $\ln\left(\frac{35}{70}\right) = -5k$ $-5k = \ln\left(\frac{1}{2}\right)$ $-5k = \ln 1 - \ln 2 \Rightarrow -5k = -\ln 2 \Rightarrow k = \frac{1}{5}\ln 2$	
	Substitutes $t = 5$ and $\vartheta = 55$ into eqn * and rearranges eqn * to make e^{5k} the subject	M1
	Takes 'lns' and proceeds to make '$\pm 5k$' the subject	dM1
	Convincing proof that $k = \frac{1}{5}\ln 2$	A1
		(3)
10(c)	$\vartheta = 20 + 70e^{-\frac{1}{5}t\ln 2}$ $\frac{d\theta}{dt} = -\frac{1}{5}\ln 2 \times (70)\ e^{-\frac{1}{5}t\ln 2}$ When $t = 10$, $\frac{d\theta}{dt} = -14\ln 2\ e^{-2\ln 2}$ $\frac{d\theta}{dt} = -\frac{7}{2}\ln 2 = -2.426015132 \ldots$ Rate of decrease of $\vartheta = 2.426°$ C/min (3dp.)	
	$\pm \alpha e^{-kt}$ where $k = \frac{1}{5}\ln 2$	M1
	$-14\ln 2\ e^{-\frac{1}{5}t\ln 2}$	A1 oe
	awrt ± 2.426	A1
		(3)
		(8 marks)

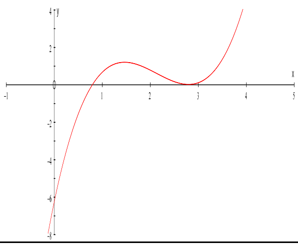
Question	Scheme	Marks
11(a)	$p = 7.5$	B1
		(1)
11(b)	$2.5 = 7.5\,e^{-4k}$	M1
	$e^{-4k} = \frac{1}{3}$	M1
	$-4k = \ln\left(\frac{1}{3}\right)$	dM1
	$-4k = -\ln(3)$	
	$k = \frac{1}{4}\ln(3)$	A1
		(4)
11(c)	$\frac{dm}{dt} = -kp\,e^{-kp}$	M1A1ft
	ft on their p and k	
	$-\frac{1}{4}\ln 3 \times 7.5\, e^{-\frac{1}{4}(\ln 3)t} = -0.6\ln 3$	
	$e^{-\frac{1}{4}(\ln 3)t} = \frac{2.4}{7.5} = (0.32)$	M1A1
	$-\frac{1}{4}(\ln 3)t = \ln(0.32)$	dM1
	$t = 4.1486\ldots$ 4.15 or awrt 4.1	A1
		(6)
		(11 marks)

AS and A level Mathematics Practice Paper – Differentiation (part 2) – Mark scheme

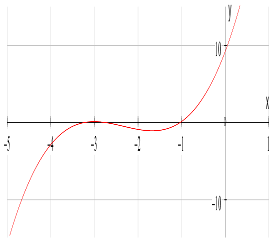
	Source paper	Question number	New spec references	Question description
1	C1 2017	2	2.2 and 7.2	Differentiation
2	C1 2016	7	2.1 and 7.2	Differentiation
3	C1 2014	7	7.2	Differentiation and related sums and differences
4	C1 2012	4	7.1 and 7.2	Differentiation
5	C2 2012	8	7.3	Differentiation
6	C2 2015	9	7.1, 7.2 and 7.3	Applications of differentiation
7	C2 Jan 2012	Q8	5.1 and 7.3	Trigonometry, Differentiation
8	C2 June 2014R	9	7.1, 7.2 and 7.3	Differentiation
9	C2 Jan 2011	10	2.6, 7.1, 7.2, 7.3	Differentiation
10	C3 Jan 2011	4	6.2, 6.3, 6.7	Exponentials and logarithms, Differentiat
11	C3 2011	Q5	6.2, 6.3, 6.7	Exponentials and logarithms, Differentiat

AS and A level Mathematics Practice Paper – Differentiation (part 2) – Mark scheme

Question	Scheme	Marks
1(a)	[$y = x^3 + 2x^2$] so $\dfrac{dy}{dx} = 3x^2 + 4x$	M1A1 **(2)**
1(b)	 Shape Touching x-axis at origin Through and not touching or stopping at -2 on x –axis. Ignore extra intersections.	B1 B1 B1 **(3)**
1(c)	At $x = -2$: $\dfrac{dy}{dx} = 3(-2)^2 + 4(-2) = 4$ At $x = 0$: $\dfrac{dy}{dx} = 0$ (Both values correct)	M1 A1 **(2)**



1(d)	Horizontal translation (touches x-axis still) $k-2$ and k marked on positive x-axis $k^2(2-k)$ (o.e) marked on negative y-axis	M1 B1 B1 **(3)**
		(10 marks)

Question	Scheme	Marks
2(a)	 Shape (cubic in this orientation) **Touching** x-axis at **–3** **Crossing** at **–1** on x-axis Intersection at **9** on y-axis	B1 B1 B1 B1 **(4)**
2(b)	$y=(x+1)(x^2+6x+9)=x^3+7x^2+15x+9$ or equiv. (possibly unsimplified) Differentiates their polynomial correctly – may be unsimplified $\frac{\mathrm{d}y}{\mathrm{d}x}=3x^2+14x+15$	B1 M1 A1 cso **(3)**
2(c)	At x = –5: $\frac{\mathrm{d}y}{\mathrm{d}x}=75-70+15=20$ At x = –5: $y=-16$ $y-(\text{"}-16\text{"})=\text{"}20\text{"}(x-(-5))$ or y = "20x" + c with (-5, -"16") used to find c $y=20x+84$	B1 B1 M1 A1 **(4)**
2(d)	Parallel: $3x^2+14x+15=\text{"}20\text{"}$ $(3x-1)(x+5)=0$ x = … $x=\frac{1}{3}$	M1 M1 A1 **(3)**
		(14 marks)

AS and A level Mathematics Practice Paper – Differentiation (part 2) – Mark scheme

Question	Scheme	Marks
3(a)	$(x^2+4)(x-3)=x^3-3x^2+4x-12$ $\dfrac{x^3-3x^2+4x-12}{2x}=\dfrac{x^2}{2}-\dfrac{3}{2}x+2-6x^{-1}$ $\dfrac{\mathrm{d}y}{\mathrm{d}x}=x-\dfrac{3}{2}+\dfrac{6}{x^2}$ oe e.g. $\dfrac{2x^3-3x^2+12}{2x^2}$	M1 M1 A1 ddM1 A1 **(5)**
3(b)	At $x=-1,\ \ y=10$ $\left(\dfrac{\mathrm{d}y}{\mathrm{d}x}=\right)-1-\dfrac{3}{2}+\dfrac{6}{1}=3.5$ $y-'10'='3.5'(x--1)$ $2y-7x-27=0$	B1 M1 A1 M1 A1 **(5)**
		(10 marks)
4(a)	$\left(\dfrac{\mathrm{d}y}{\mathrm{d}x}=\right)6x^2+2kx+5$	M1 A1 **(2)**
4(b)	Gradient of given line is $\dfrac{17}{2}$ $\left(\dfrac{\mathrm{d}y}{\mathrm{d}x}\right)_{x=-2}=6(-2)^2+2k(-2)+5$ "$24-4k+5$" = "$\dfrac{17}{2}\Rightarrow$" $k=\dfrac{41}{8}$"	B1 M1 dM1 A1 **(4)**
4(c)	$y=-16+4k-10+6=4"k"-20=\dfrac{1}{2}$	M1 A1 **(2)**
4(d)	$y-"\dfrac{1}{2}"="\dfrac{17}{2}"\left(x-^{-}2\right)\Rightarrow-17x+2y-35=0$ or $y="\dfrac{17}{2}"x+c\Rightarrow c=\ldots\Rightarrow-17x+2y-35=0$ or $2y-17x=1+34\Rightarrow-17x+2y-35=0$	M1 A1 **(2)**
		(10 marks)

AS and A level Mathematics Practice Paper – Differentiation (part 2) – Mark scheme

Question	Scheme	Marks
5(a)	$C: y = 2x - 8\sqrt{x} + 5, \quad x \geqslant 0$ So, $y = 2x - 8x^{\frac{1}{2}} + 5$ $\dfrac{dy}{dx} = 2 - 4x^{-\frac{1}{2}} + \{0\}$ $\quad (x > 0)$	M1 A1 A1 **(3)**
5(b)	(When $x = \frac{1}{4}$, $y = 2\left(\frac{1}{4}\right) - 8\sqrt{\left(\frac{1}{4}\right)} + 5$ so) $\quad y = \frac{3}{2}$	B1
	(gradient $= \dfrac{dy}{dx} =$) $2 - \dfrac{4}{\sqrt{\left(\frac{1}{4}\right)}}$ $\{= -6\}$	M1
	Either : $y - "\frac{3}{2}" = "-6"\left(x - \frac{1}{4}\right)$ **or**: $y = "-6"x + c$ and $"\frac{3}{2}" = "-6"\left(\frac{1}{4}\right) + c \Rightarrow c = "3"$	M1
	So $\underline{y = -6x + 3}$	A1 **(4)**
5(c)	Tangent at *Q* is parallel to $2x - 3y + 18 = 0$ ($y = \frac{2}{3}x + 6 \Rightarrow$) Gradient $= \frac{2}{3}$. so tangent gradient is $\frac{2}{3}$	B1
	So, $"2 - \dfrac{4}{\sqrt{x}}" = "\dfrac{2}{3}"$ — Sets their gradient function = their numerical gradient.	M1
	$\Rightarrow \dfrac{4}{3} = \dfrac{4}{\sqrt{x}} \Rightarrow x = 9$ — Ignore extra answer *x* = –9	A1
	When $x = 9$, $y = 2(9) - 8\sqrt{9} + 5 = -1$ — Substitutes their found *x* into equation of curve.	M1
	$y = -1.$	A1 **(5)**
		(12 marks)

AS and A level Mathematics Practice Paper – Differentiation (part 2) – Mark scheme

Question	Scheme	Marks
6(a)	$\left(\frac{\mathrm{d}y}{\mathrm{d}x}=\right)\frac{3}{2}x^2-\frac{27}{2}x^{\frac{1}{2}}-8x^{-2}$	M1A1 A1A1 **(4)**
6(b)	$x = 4 \Rightarrow y = \frac{1}{2}\times 64 - 9\times 2^3 + \frac{8}{4} + 30$ $= 32 - 72 + 2 + 30 = \underline{-8}$	M1 A1 cso **(2)**
6(c)	$x = 4 \Rightarrow y' = \frac{3}{2}\times 4^2 - \frac{27}{2}\times 2 - \frac{8}{16}$ $= 24 - 27 - \frac{1}{2} = -\frac{7}{2}$ Gradient of the normal: $-1 \div$"$\frac{7}{2}$" Equation of normal: $y - -8 = \frac{2}{7}(x-4)$ $\underline{7y - 2x + 64 = 0}$	M1 A1 M1 M1A1ft A1 **(6)**
		(12 marks)

AS and A level Mathematics Practice Paper – Differentiation (part 2) – Mark scheme

Question	Scheme	Marks
7(a)	$\left(\frac{1}{2}, 0\right)$	B1
		(1)
7(b)	$\frac{\mathrm{d}y}{\mathrm{d}x} = x^{-2}$	M1A1
	At $x = \frac{1}{2}$, $\frac{\mathrm{d}y}{\mathrm{d}x} = \left(\frac{1}{2}\right)^{-2} = 4 \quad (= m)$	A1
	Gradient of normal $= -\frac{1}{m} \quad \left(= -\frac{1}{4}\right)$	M1
	Equation of normal: $y - 0 = -\frac{1}{4}\left(x - \frac{1}{2}\right)$	M1
	$2x + 8y - 1 = 0$ **(*)**	A1cso
		(6)
7(c)	$2 - \frac{1}{x} = -\frac{1}{4}x + \frac{1}{8}$	M1
	[= $2x^2 + 15x - 8 = 0$ **]** <u>or</u> [$8y^2 - 17y = 0$]	
	$(2x-1)(x+8) = 0$ leading to $x = \ldots$	M1
	$x = \left[\frac{1}{2}\right]$ or -8	A1
	$y = \frac{17}{8}$ (or exact equivalent)	A1ft
		(4)
		(11 marks)

AS and A level Mathematics Practice Paper – Differentiation (part 2) – Mark scheme

Question	Scheme	Marks
8(a)	Substitutes $x = 2$ into $y = 20 - 4\times 2 - \frac{18}{2}$ and gets 3	B1
	$\frac{\mathrm{d}y}{\mathrm{d}x} = -4 + \frac{18}{x^2}$	M1 A1
	Substitute $x = 2 \Rightarrow \frac{\mathrm{d}y}{\mathrm{d}x} = \left(\frac{1}{2}\right)$ then finds negative reciprocal (-2)	dM1
	States or uses $y - 3 = -2(x - 2)$ or $y = -2x + c$ with their (2, 3)	dM1
	to deduce that $y = -2x + 7$ *	A1*
		(6)
8(b)	Put $20 - 4x - \frac{18}{x} = -2x + 7$ and simplify to give $2x^2 - 13x + 18 = 0$	M1A1
	Or put $y = 20 - 4\left(\frac{7-y}{2}\right) - \frac{18}{\left(\frac{7-y}{2}\right)}$ to give $y^2 - y - 6 = 0$	
	$(2x-9)(x-2) = 0$ so $x =$ or $(y - 3)(y + 2) = 0$ so $y =$	dM1
	$x = \frac{9}{2}, y = -2$	A1, A1
		(5)
		(11 marks)

Question	Scheme	Marks
9(a)	$\dfrac{dy}{dx} = 12x^2 + 18x - 30$	M1
	Either: Substitute x = 1 to give $\dfrac{dy}{dx} = 12 + 18 - 30 = 0$ Or: Solve $\dfrac{dy}{dx} = 12x^2 + 18x - 30 = 0$ to give x =	A1
	Either: So turning point (all correct work so far) Or: Deduce x = 1 from correct work	A1cso
		(3)
9(b)	When x = 1, y = 4 + 9 –30 – 8 = – 25	B1
	Area of triangle ABP = $\frac{1}{2}$ × 1 × 25 = 12.5 (Where P is at (1, 0))	B1
	$\int(4x^3 + 9x^2 - 30x - 8)dx = x^4 + \frac{9}{3}x^3 - \frac{30}{2}x^2 - 8c\,\{+c\}$ or $x^4 + 3x^3 - 15x^2 - 8c\,\{+c\}$	M1A1
	$\left[x^4 + 3x^3 - 15x^2 - 8c\right]_{-\frac{1}{4}}^{1} =$ (1 + 3 – 15 – 8) – $\left(\left(-\frac{1}{4}\right)^4 + 3\left(-\frac{1}{4}\right)^3 - 15\left(-\frac{1}{4}\right)^2 - 8\left(-\frac{1}{4}\right)\right) =$	dM1
	(– 19) $- \dfrac{261}{256}$ or – 19 – 1.02	
	So Area = “*their* 12.5” + “*their* $\dfrac{5}{256}$ ” or or “12.5” + “ 20.02” or “12.5” + “*their* $\dfrac{5125}{256}$ ”	ddM1
	= 32.52 (NOT – 32.52)	A1
		(7)
		(10 marks)

EDEXCEL CORE MATHEMATICS C1 (6663) – MAY 2017 FINAL MARK SCHEME

	Source paper	Question number	New spec references	Question description
1	C1 Jan 2012	8	7.2, 2.7 and 2.9	Differentiation, graphs and their transformations
2	C1 2011	10	2.7, 7.2 and 7.3	Differentiation, graphs and their transformations
3	C1 2015	6	7.2 and 7.3	Differentiation, calculation of equation of tangent
4	C1 2016	11	3.1, 7.2 and 7.3	Parallel lines, tangent to curve
5	C1 Jan 2013	11	3.1, 7.1, 7.2 and 7.3	Differentiation, straight lines
6	C1 Jan 2011	11	3.1, 7.2, 7.3	Differentiation, straight lines
7	C1 Jan 2012	10	7.2, 7.3, 2.4, 2.6	Differentiation, quadratics, graphs and their transf
8	C1 June 2014R	11	7.2, 7.3, 2.4	Equation of normal, intersection of graphs
9	C2 2017	10	7.2, 7.3, 8.2 and 8.3	Differentiation and turning point, definite integrati

AS and A level Mathematics Practice Paper – Exponentials and logarithms
Mark scheme

Question	Scheme		Marks
1	$2\log x = \log x^2$		B1
	$\log_3 x^2 - \log_3(x-2) = \log_3 \dfrac{x^2}{x-2}$		M1
	$\dfrac{x^2}{x-2} = 9$		A1 o.e.
	Solves $x^2 - 9x + 18 = 0$ to give $x = ...$		M1
	$x = 3$, x = 6		A1
			(5 marks)
2(a)	$\log_3 3x^2 = \log_3 3 + \log_3 x^2$ or $\log y - \log x^2 = \log 3$ or $\log y - \log 3 = \log x^2$		B1
	$\log_3 x^2 = 2\log_3 x$		B1
	Using $\log_3 3$ =1		B1
			(3)
2(b)	$3x^2 = 28x - 9$		M1
	Solves $3x^2 - 28x + 9 = 0$ to give $x = \frac{1}{3}$ or x = 9		M1 A1
			(3)
			(6 marks)
3(a)	$2\log(x+15) = \log(x+15)^2$		B1
	$\log(x+15)^2 - \log x = \log \dfrac{(x+15)^2}{x}$	Correct use of $\log a - \log b = \log \dfrac{a}{b}$	M1
	$2^6 = 64$ or $\log_2 64 = 6$	64 used in the correct context	B1
	$\log_2 \dfrac{(x+15)^2}{x} = 6 \Rightarrow \dfrac{(x+15)^2}{x} = 64$	Removes logs correctly	M1
	$\Rightarrow x^2 + 30x + 225 = 64x$ $or\ x + 30 + 225x^{-1} = 64$	Must see expansion of $(x+15)^2$ to score the final mark.	
	$\therefore x^2 - 34x + 225 = 0$ *		A1
			(5)
3(b)	$(x-25)(x-9) = 0 \Rightarrow x = 25$ or $x = 9$	M1: Correct attempt to solve the **given** quadratic as far as x =... A1: Both 25 and 9	M1 A1
			(2)
			(7 marks)

AS and A level Mathematics Practice Paper – Exponentials and logarithms
Mark scheme

Question	Scheme	Marks
4(i)	$\log_2\left(\frac{2x}{5x+4}\right) = -3$ or $\log_2\left(\frac{5x+4}{2x}\right) = 3$, or $\log_2\left(\frac{5x+4}{x}\right) = 4$ (see special case 2)	M1
	$\left(\frac{2x}{5x+4}\right) = 2^{-3}$ or $\left(\frac{5x+4}{2x}\right) = 2^3$ or $\left(\frac{5x+4}{x}\right) = 2^4$ or $\left(\log_2\left(\frac{2x}{5x+4}\right)\right) = \log_2\left(\frac{1}{8}\right)$	M1
	$16x = 5x + 4 \Rightarrow x =$ (depends on previous Ms and must be this equation or equivalent)	dM1
	$x = \frac{4}{11}$ or exact recurring decimal $0.\dot{3}\dot{6}$ after correct work	A1 **cso**
		(4)
4(ii)	$\log_a y + \log_a 2^3 = 5$	M1
	$\log_a 8y = 5$ Applies product law of logarithms.	dM1
	$y = \frac{1}{8}a^5$ $y = \frac{1}{8}a^5$	A1cao
		(3)
		(7 marks)

AS and A level Mathematics Practice Paper – Exponentials and logarithms
Mark scheme

Question	Scheme	Marks
5(i)	Use of power rule so $\log(x+a)^2 = \log 16a^6$ or $2\log(x+a) = 2\log 4a^3$ or $\log(x+a) = \log(16a^6)^{\frac{1}{2}}$	M1
	Removes logs and square roots, **or** halves then removes logs to give $(x+a) = 4a^3$ Or $x^2 + 2ax + a^2 - 16a^6 = 0$ followed by factorisation or formula to give $x = \sqrt{16a^6} - a$	M1
	($x =$) $4a^3 - a$ (depends on previous M's and must be this expression or equivalent)	A1cao
		(3)
5(ii)	**Way 1**	
	$\log_3 \dfrac{(9y+b)}{(2y-b)} = 2$ — Applies quotient law of logarithms	M1
	$\dfrac{(9y+b)}{(2y-b)} = 3^2$ — Uses $\log_3 3^2 = 2$	M1
	$(9y+b) = 9(2y-b) \Rightarrow y =$ — Multiplies across and makes *y* the subject	M1
	$y = \frac{10}{9}b$	A1cso
	Way 2	
	$\log_3(9y+b) = \log_3 9 + \log_3(2y-b)$ — 2nd M mark	M1
	$\log_3(9y+b) = \log_3 9(2y-b)$ — 1st M mark	M1
	$(9y+b) = 9(2y-b) \Rightarrow y = \frac{10}{9}b$ Multiplies across and makes *y* the subject	M1 A1cso
		(4)
		(7 marks)

AS and A level Mathematics Practice Paper – Exponentials and logarithms
Mark scheme

Question	Scheme		Marks
6(a)	$5^x = 10$ and (b) $\log_3(x-2) = -1$		
	$x = \dfrac{\log 10}{\log 5}$ or $x = \log_5 10$		M1
	$x \{= 1.430676558...\} = 1.43$ (3 sf)	1.43	A1 **cao**
			(2)
6(b)	$(x-2) = 3^{-1}$	$(x-2) = 3^{-1}$ or $\frac{1}{3}$	M1 oe
	$x \{= \frac{1}{3} + 2\} = 2\frac{1}{3}$	$2\frac{1}{3}$ or $\frac{7}{3}$ or $2.\dot{3}$ or awrt 2.33	A1
			(2)
			(4 marks)
7(a)	$e^{3x-9} = 8 \Rightarrow 3x - 9 = \ln 8$		M1
	$\Rightarrow x = \dfrac{\ln 8 + 9}{3}, = \ln 2 + 3$		A1 A1
			(3 marks)

AS and A level Mathematics Practice Paper – Exponentials and logarithms
Mark scheme

Question	Scheme	Marks
8(a)	Attempt $\mathrm{f}(3)$ or $\mathrm{f}(-3)$ Use of long division is M0A0 as factor theorem was required.	M1
	$\mathrm{f}(-3) = 162 - 63 - 120 + 21 = 0$ so (x + 3) is a factor	A1
		(2)
8(b)	Either (Way 1)	
	$\mathrm{f}(x) = (x+3)(-6x^2 + 11x + 7)$	M1 A1
	$= (x+3)(-3x+7)(2x+1)$ or $-(x+3)(3x-7)(2x+1)$	M1 A1
	Or (Way 2)	**(4)**
	Uses trial or factor theorem to obtain x = − 1/2 **or** x = 7/3	M1
	Uses trial or factor theorem to obtain both x = − 1/2 **and** x = 7/3	A1
	Puts three factors together (see notes below)	M1
	Correct factorisation : $(x+3)(7-3x)(2x+1)$ or $-(x+3)(3x-7)(2x+1)$ oe	A1
	Or (Way 3)	
	No working three factors $(x+3)(-3x+7)(2x+1)$ otherwise need working	M1 A1 M1 A1
		(4)
8(c)	$2^y = \frac{7}{3}, \rightarrow \log\left(2^y\right) = \log\left(\frac{7}{3}\right)$ or $y = \log_2\left(\frac{7}{3}\right)$ or $\frac{\log(7/3)}{\log 2}$	B1 M1
	$\{y = 1.222392421...\} \Rightarrow y =$ awrt 1.22	A1
		(3)
		(9 marks)

AS and A level Mathematics Practice Paper – Exponentials and logarithms
Mark scheme

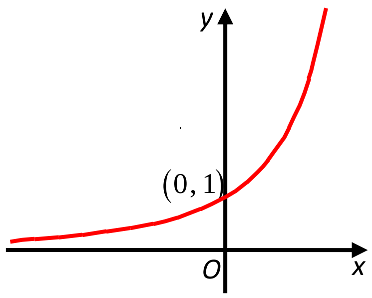
Question	Scheme	Marks
9(i)	$8^{2x+1} = 24$	
	$(2x+1)\log 8 = \log 24$ or $(2x+1) = \log_8 24$ or $8^{2x} = 3$ and so $(2x)\log 8 = \log 3$ or $(2x) = \log_8 3$	M1
	$x = \frac{1}{2}\left(\frac{\log 24}{\log 8} - 1\right)$ or $x = \frac{1}{2}(\log_8 24 - 1)$ $x = \frac{1}{2}\left(\frac{\log 3}{\log 8}\right)$ or $x = \frac{1}{2}(\log_8 3)$ o.e.	dM1
	= 0.264	A1
		(3)
9(ii)	$\log_2(11y - 3) - \log_2 3 - 2\log_2 y = 1$	M1
	$\log_2 \frac{(11y-3)}{3y^2} = 1$ or $\log_2 \frac{(11y-3)}{y^2} = 1 + \log_2 3 = 2.58496501$	dM1
	$\log_2 \frac{(11y-3)}{3y^2} = \log_2 2$ or $\log_2 \frac{(11y-3)}{y^2} = \log_2 6$ (allow awrt 6 if replaced by 6 later)	B1
	Obtains $6y^2 - 11y + 3 = 0$ o.e. i.e. $6y^2 = 11y - 3$ for example	A1
	Solves quadratic to give y =	ddM1
	$y = \frac{1}{3}$ and $\frac{3}{2}$ (need both- one should not be rejected)	A1
		(6)
		(9 marks)

AS and A level Mathematics Practice Paper – Exponentials and logarithms
Mark scheme

Question	Scheme	Marks
10(i)	$\log_3\left(\dfrac{3b+1}{a-2}\right) = -1$ or $\log_3\left(\dfrac{a-2}{3b+1}\right) = 1$	M1
	$\dfrac{3b+1}{a-2} = 3^{-1}\left\{= \dfrac{1}{3}\right\}$ or $\left(\dfrac{a-2}{3b+1}\right) = 3$	M1
	$\{9b+3 = a-2 \Rightarrow\}\ b = \dfrac{1}{9}a - \dfrac{5}{9}$	A1 oe
		(3)
10(ii)	$32(2^{2x}) - 7(2^x) = 0$	M1
	So, $2^x = \dfrac{7}{32}$	A1 oe
	$x\log 2 = \log\left(\dfrac{7}{32}\right)$ or $x = \dfrac{\log\left(\frac{7}{32}\right)}{\log 2}$ or $x = \log_2\left(\dfrac{7}{32}\right)$	dM1
	$x = -2.192645...$	A1
		(4)
		(7 marks)
11(i)	$y\log 5 = \log 8$	M1
	$\left\{y = \dfrac{\log 8}{\log 5}\right\} = 1.2920...$ | awrt 1.29	A1
		(2)
11(ii)	$\log_2(x+15) - 4 = \frac{1}{2}\log_2 x$	
	$\log_2(x+15) - 4 = \log_2 x^{\frac{1}{2}}$	M1
	$\log_2\left(\dfrac{x+15}{x^{\frac{1}{2}}}\right) = 4$	M1
	$\left(\dfrac{x+15}{x^{\frac{1}{2}}}\right) = 2^4$	M1
	$x - 16x^{\frac{1}{2}} + 15 = 0$ or e.g. $x^2 + 225 = 226x$	A1
	$(\sqrt{x}-1)(\sqrt{x}-15) = 0 \Rightarrow \sqrt{x} = ...$	**ddd**M1
	$\{\sqrt{x} = 1, 15\}$ $x = 1, 225$	A1
		(6)

Question	Scheme	Marks
		(8 marks)

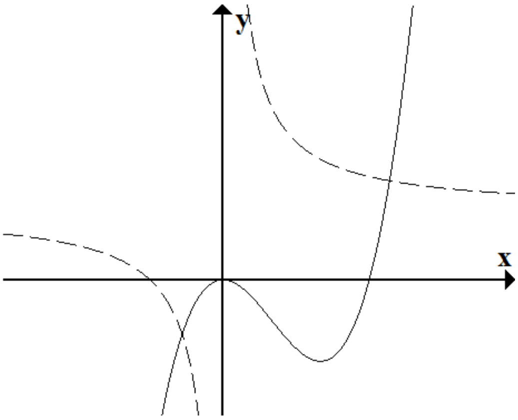
AS and A level Mathematics Practice Paper – Exponentials and logarithms
Mark scheme

Question	Scheme	Marks
2(a)	Graph of $y = 3^x$ and solving $3^{2x} - 9(3^x) + 18 = 0$ 	B1 B1 **(2)**
12(b)	$\left(3^x\right)^2 - 9\left(3^x\right) + 18 = 0$ or $y = 3^x \Rightarrow y^2 - 9y + 18 = 0$ $\{(y-6)(y-3) = 0$ or $\left(3^x - 6\right)\left(3^x - 3\right) = 0\}$ $y = 6,\ \ y = 3$ or $3^x = 6,\ 3^x = 3$ $\left\{3^x = 6 \Rightarrow\right\}\ x\log 3 = \log 6$ or $x = \dfrac{\log 6}{\log 3}$ or $x = \log_3 6$ $x = 1.63092...$ $x = 1$	M1 A1 **d**M1 A1**cso** B1 **(5)**
		(7 marks)

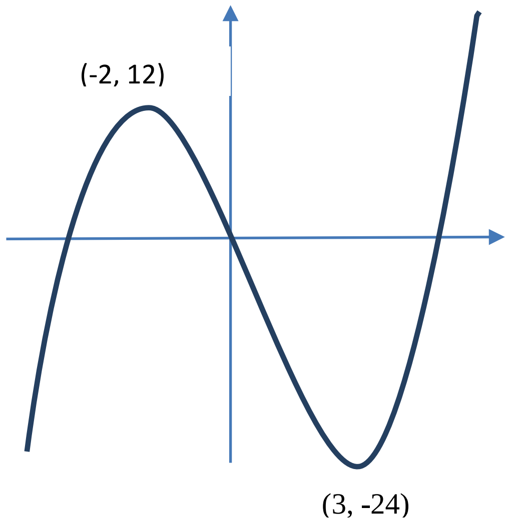
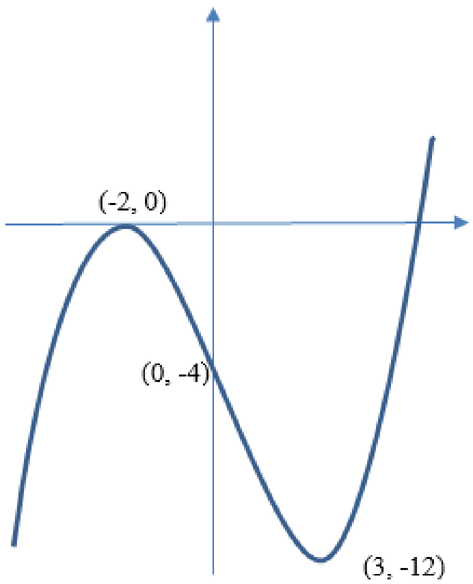
EDEXCEL CORE MATHEMATICS C1 (6663) – MAY 2017 FINAL MARK SCHEME

	Source paper	**Question number**	**New spec references**	**Question description**
1	C2 2012	2	6.3, 6.4 and 2.3	Laws of logarithms
2	C2 Jan 2012	Q4	6.3 and 6.4	Laws of logarithms
3	C2 Jan 2013	Q6	6.3 and 6.4	Laws of logarithms
4	C2 2013	7	6.3, 6.4	Laws of logarithms
5	C2 2017	7	6.3 and 6.4	Laws of logs
6	C2 2011	Q3	6.3 and 6.5	Exponentials and logarithms
7	C3 2017	2	6.3, 6.4	Exponential equation
8	C2 2017	6	2.6 and 6.5	Factor theorem and factorisation of cubic, a^x a
9	C2 2015	7	6.3, 6.4 and 6.5	Exponentials and logarithms
10	C2 2016	8	2.3, 6.3, 6.4, 6.5	Exponentials and logarithms
11	C2 June 2014R	8	6.4, 6.5	Exponentials and logarithms
12	C2 2014	8	6.1, 6.3 and 6.5 and 2.3	Exponentials and logarithms

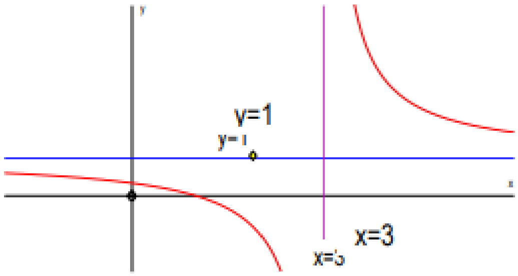
AS and A level Mathematics Practice Paper – Graphs and transformations
Mark scheme

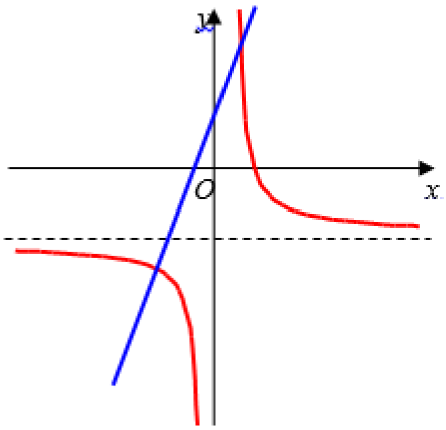
Question	Scheme	Marks
1(a)	(a) - 1 accept (–1, 0)	B1 **(1)**
1(b)	 Shape Touches at (0,0) Crosses at (2,0)	B1 B1 B1 **(3)**
1(c)	(c) 2 solutions as **curves** cross twice	B1 ft **(1)**
		(5 marks)

AS and A level Mathematics Practice Paper – Graphs and transformations
Mark scheme

Question	Scheme	Marks
2(a)		B1 B1 **(2)**
2(b)		M1 A1 A1 **(3)**
		(5 marks)

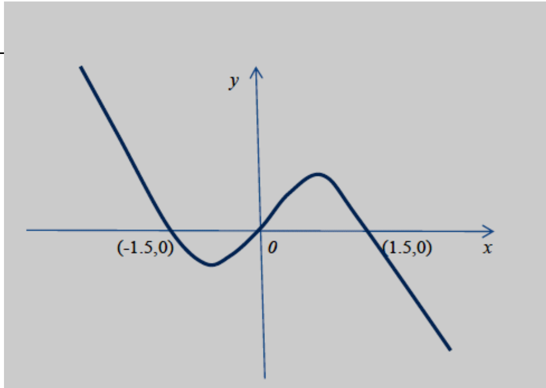
AS and A level Mathematics Practice Paper – Graphs and transformations
Mark scheme

Question	Scheme	Marks
3(a)		
	Correct shape with a single crossing of each axis	B1
	y = 1 labelled or stated	B1
	x = 3 labelled or stated	B1
		(3)
3(b)	Horizontal translation so crosses the x-axis at (1, 0)	B1
	New equation is $(y=)\dfrac{x\pm 1}{(x\pm 1)-2}$	M1
	When x = 0 y =	M1
	$= \dfrac{1}{3}$	A1
		(4)
		(7 marks)

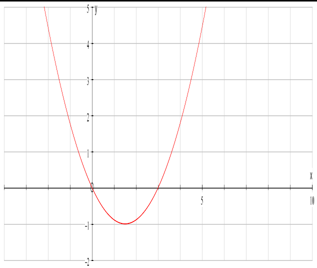
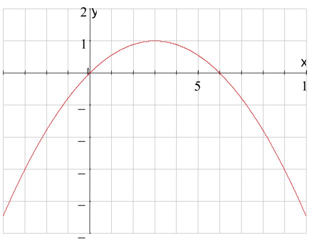
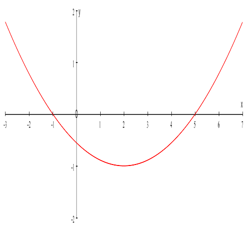
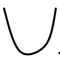
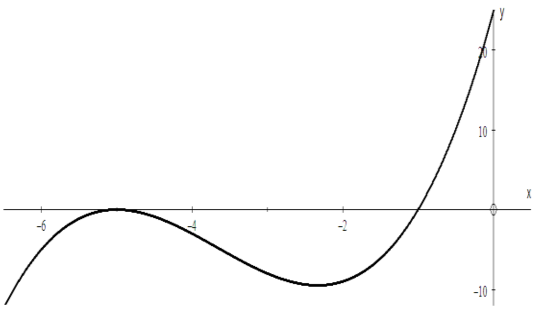
Question	Scheme	Marks
4(a)	Check graph in question for possible answers and space below graph for answers to part (b)  $y = \frac{2}{x}$ is translated up or down $y = \frac{2}{x} - 5$ is in the correct position Intersection with x-axis at $\left(\frac{2}{5}, \{0\}\right)$ **only** Independent mark $y = 4x + 2$: attempt at straight line, with positive gradient with positive y intercept Intersection with x-axis at $\left(-\frac{1}{2}, \{0\}\right)$ **and** y-axis at $\left(\{0\}, 2\right)$.	M1 A1 B1 B1 B1 **(5)**
4(b)	Asymptotes : $x = 0$ (or y-axis) and $y = -5$. An asymptote stated correctly (Lose second B mark for extra asymptotes) Independent of part (a) These two lines only Not ft their graph.	B1 B1 **(2)**
4(c)	Method 1: $\frac{2}{x} - 5 = 4x + 2$ Method 2: $\frac{y-2}{4} = \frac{2}{y+5}$ $4x^2 + 7x - 2 = 0 \Rightarrow x =$ $y^2 + 3y - 18 = 0 \rightarrow y =$ $x = -2, \frac{1}{4}$ $y = -6, 3$ When $x = -2, y = -6$ When $y = -6, x = -2$ When $x = \frac{1}{4}, y = 3$ When $y = 3, x = \frac{1}{4}$	M1 dM1 A1 M1A1 **(5)**

Question	Scheme	Marks
		(12 marks)

AS and A level Mathematics Practice Paper – Graphs and transformations
Mark scheme

Question	Scheme	Marks
5(a)	$9x-4x^3 = x(9-4x^2)$ or $-x(4x^2-9)$	B1
	$9-4x^2 = (3+2x)(3-2x)$ or $4x^2-9 = (2x-3)(2x+3)$	M1
	$9x-4x^3 = x(3+2x)(3-2x)$	A1
		(3)
5(b)		M1
		B1
		A1
		(3)
5(c)	$A=(-2,\ 14),\quad B=(1,\ 5)$	B1 B1
	$(AB=)\sqrt{(-2-1)^2+(14-5)^2}\ (=\sqrt{90})$	M1
	$(AB=)3\sqrt{10}$ cao	A1
		(4)
		(10 marks)

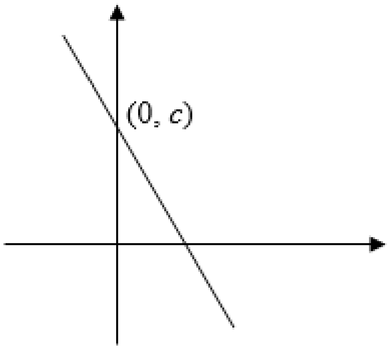
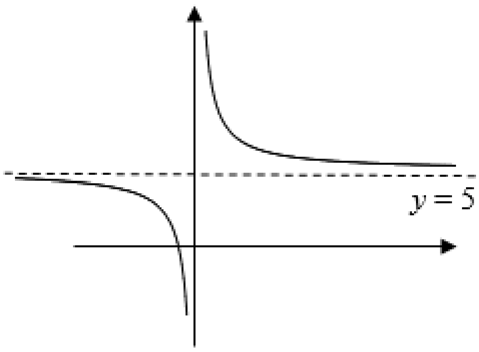
AS and A level Mathematics Practice Paper – Graphs and transformations
Mark scheme

Question	Scheme		Marks
6(a)		Shape  through (0, 0) (3, 0) (1.5, –1)	B1 B1 B1 **(3)**
6(b)		Shape  (0, 0) and (6, 0) (3, 1)	B1 B1 B1 **(3)**
6(c)		Shape  <u>not</u> through (0, 0) Minimum in 4th quadrant (–*p*, 0) and (6 – *p*, 0) (3 – *p*, –1)	M1 A1 B1 B1 **(4)**
			(10 marks)
7(a)		Horizontal translation Touching at (–5, 0) The right hand tail of their cubic shape crossing at (–1, 0)	B1 B1 B1 **(3)**
7(b)	$(x+5)^2(x+1)$		B1 **(1)**
7(c)	When $x = 0$, $y = 25$		M1 A1 **(2)**

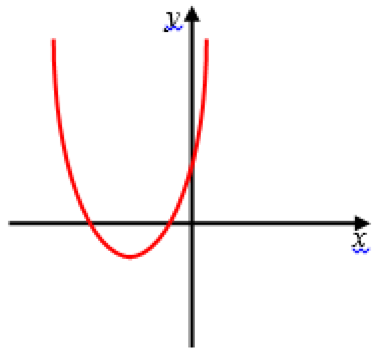
AS and A level Mathematics Practice Paper – Graphs and transformations
Mark scheme

Question	Scheme	Marks
		(6 marks)

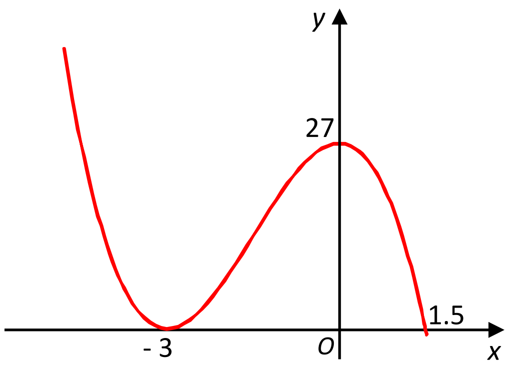
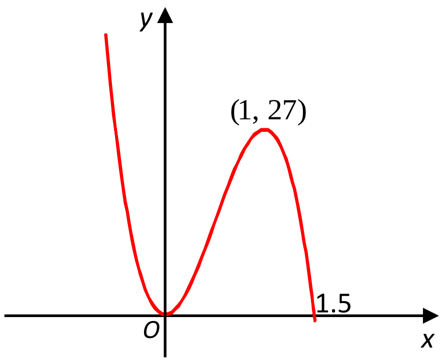
AS and A level Mathematics Practice Paper – Graphs and transformations
Mark scheme

Question	Scheme	Marks
8(a)(i)		B1 B1 **(2)**
8(a)(ii)		B1 B1 **(2)**
8(b)	$\frac{1}{x}+5=-3x+c \Rightarrow 1+5x=-3x^2+cx$ $\Rightarrow 3x^2+5x-cx+1=0$ $b^2-4ac=(5-c)^2-4\times1\times3$ $(5-c)^2>12*$	M1 M1 A1* **(3)**
8(c)	$(5-c)^2=12 \Rightarrow (c=)5\pm\sqrt{12}$ or $(5-c)^2=12 \Rightarrow c^2-10c+13=0$ $\Rightarrow (c=)\frac{-^{-}10\pm\sqrt{(-10)^2-4\times13}}{2}$ $c<"5-\sqrt{12}"$, $c>"5+\sqrt{12}"$	 M1A1 M1

Question	Scheme	Marks
	$0 < c < 5 - \sqrt{12}$, $c > 5 + \sqrt{12}$	A1 **(4)**
		(11 marks)

Question	Scheme	Marks
9(a)	This may be done by completion of square or by expansion and comparing coefficients	
	$a = 4$	B1
	$b = 1$	B1
	All three of $a = 4$, $b = 1$ and $c = –1$	B1
		(3)
9(b)		
	U shaped quadratic graph.	M1
	The curve is correctly positioned with the minimum in the third quadrant. . It crosses *x* axis twice on negative *x* axis and *y* axis once on positive *y* axis.	A1
	Curve cuts *y*-axis at $(\{0\}, 3)$. only	B1
	Curve cuts *x*-axis at $\left(-\frac{3}{2}, \{0\}\right)$ and $\left(-\frac{1}{2}, \{0\}\right)$.	B1
		(4)
		(7 marks)

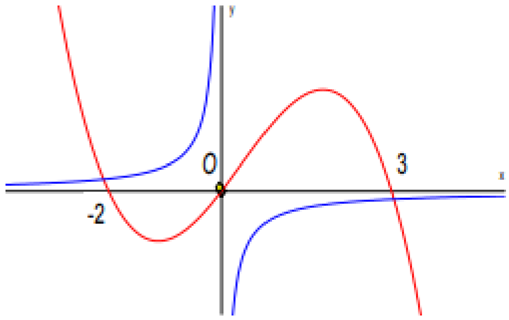
AS and A level Mathematics Practice Paper – Graphs and transformations
Mark scheme

Question	Scheme		Marks
10(a)	{Coordinates of *A* are} $(4.5, 0)$		B1 **(1)**
10(b)(i)	 	Horizontal translation -3 and their ft 1.5 on postitive *x*-axis Maximum at 27 marked on the *y*-axis	M1 A1 ft B1 **(3)**
10(b)(ii)	 	Correct shape, minimum at $(0, 0)$ and a maximum within the first quadrant. 1.5 on *x*-axis Maximum at $(1, 27)$	M1 A1 ft B1 **(3)**
10(c)	$\{k =\}\ -17$		B1 **(1)**
			(8 marks)

AS and A level Mathematics Practice Paper – Graphs and transformations
Mark scheme

Question	Scheme	Marks
11(a)(i)	$k=\left(-5\right)^2\times 3=75$	M1A1
11(a)(ii)	$c=\frac{5}{2}$ only	B1 **(3)**
11(b)	$\mathrm{f}(x)=(2x-5)^2(x+3)=\left(4x^2-20x+25\right)(x+3)=4x^3-8x^2-35x+75$ $\left(\mathrm{f}'(x)=\right)12x^2-16x-35*$	M1 M1A1* **(3)**
11(c)	$\mathrm{f}'(3)=12\times 3^2-16\times 3-35$ $12x^2-16x-35='25'$ $12x^2-16x-60=0$ $(x-3)(12x+20)=0\Rightarrow x=\ldots$ $x=-\frac{5}{3}$	M1 **d**M1 A1 cso **dd**M1 A1 cso **(5)**
		(11 marks)

AS and A level Mathematics Practice Paper – Graphs and transformations
Mark scheme

Question	Scheme	Marks
12(a)		
(i)	Correct shape (-ve cubic)	B1
	Crossing at (-2, 0)	B1
	Through the origin	B1
	Crossing at (3,0)	B1
(ii)	2 branches in correct quadrants not crossing axes	B1
	One intersection with cubic on each branch	B1
		(6)
12(b)	"2" solutions	B1ft
	Since only "2" intersections	dB1ft
		(2)
		(8 marks)

EDEXCEL CORE MATHEMATICS C1 (6663) – MAY 2017 FINAL MARK SCHEME

	Source paper	Question number	New spec references	Question description
1	C1 2014	4	2.7	Graphs of functions/intersections to solv equations
2	C1 2016	4	2.9	Transformation of graphs
3	C1 Jan 2011	5	2.7 and 2.9	Graphs and their transformations
4	C1 Jan 2013	6	2.3, 2.4 and 2.9	Simultaneous equations, Graphs and thei transformations
5	C1 2015	8	2.6, 2.7 and 3.1	Manipulation of cubic and graph
6	C1 2011	8	2.9	Graphs and their transformations
7	C1 2013	8	2.6, 2.7 and 2.9	Graphs, algebraic manipulation of polyno
8	C1 2017	9	2.3, 2.4, 2.5, 2.7 and 2.9	Graphs, intersections and discriminant
9	C1 Jan 2013	10	2.3	Quadratics, Graphs and their transformat
10	C1 2012	10	2.7 and 2.9	Graphs and their transformations
11	C1 2017	10	2.3, 2.6, 2.9, 7.2,	Cubic function, transformations and grad
12	C1 Jan 2011	10	2.4 and 2.7	Quadratics, Polynomials, Factor theorem, and their transformations

AS and A level Mathematics Practice Paper – Integration – Mark scheme

Question	Scheme	Marks
1	$\left\{\int\left(6x^2+\frac{2}{x^2}+5\right)\mathrm{d}x\right\} = \frac{6x^3}{3}+\frac{2x^{-1}}{-1}+5x\ (+c)$	M1 A1
	$= 2x^3 - 2x^{-1}\ ;+5x+c$	A1; A1
		(4 marks)
2	$\frac{2}{5}x^5 - \frac{4}{\frac{1}{2}}x^{\frac{1}{2}} + 3x$	M1 A1 A1
	$= \frac{2}{5}x^5 - 8x^{\frac{1}{2}} + 3x + c$	A1
		(4 marks)
3	$\int\left(2x^5 - \frac{1}{4}x^{-3} - 5\right)\mathrm{d}x$	
	$x^n \rightarrow x^{n+1}$	M1
	$2\times\frac{x^{5+1}}{6}$ or $-\frac{1}{4}\times\frac{x^{-3+1}}{-2}$	A1
	Two of: $\frac{1}{3}x^6,\ \frac{1}{8}x^{-2},\ -5x$	A1
	$\frac{1}{3}x^6 + \frac{1}{8}x^{-2} - 5x + c$	A1
		(4 marks)
4	$\left\{\int\left(\frac{x^3}{6}+\frac{1}{3x^2}\right)\mathrm{d}x\right\} = \frac{x^4}{6(4)} + \frac{x^{-1}}{(3)(-1)}$	M1A1A1
	$\left\{\int_1^{\sqrt{3}}\left(\frac{x^3}{6}+\frac{1}{3x^2}\right)\mathrm{d}x\right\} = \left(\frac{(\sqrt{3})^4}{24} + \frac{(\sqrt{3})^{-1}}{-1(3)}\right) - \left(\frac{(1)^4}{24} + \frac{(1)^{-1}}{-1(3)}\right)$	**d**M1
	$= \left(\frac{9}{24} - \frac{1}{3\sqrt{3}}\right) - \left(\frac{1}{24} - \frac{1}{3}\right) = \frac{2}{3} - \frac{1}{9}\sqrt{3}$	A1**cso**
		(5 marks)

Question	Scheme	Marks
5	$\int\left(\frac{1}{8}x^3+\frac{3}{4}x^2\right)\,\mathrm{d}x = \frac{x^4}{32}+\frac{x^3}{4}\ \{+c\}$	M1A1
	$\left[\frac{x^4}{32}+\frac{x^3}{4}\right]_{-4}^{2} = \left(\frac{16}{32}+\frac{8}{4}\right)-\left(\frac{256}{32}+\frac{(-64)}{4}\right)$	
	or	
	$\left[\frac{x^4}{32}+\frac{x^3}{4}\right]_{-4}^{0} = (0)-\left(\frac{(-4)^4}{32}+\frac{(-4)^3}{4}\right)$ added to	dM1
	$\left[\frac{x^4}{32}+\frac{x^3}{4}\right]_{0}^{2} = \left(\frac{(2)^4}{32}+\frac{(2)^3}{4}\right)-(0)$	
	$=\frac{21}{2}$ $\qquad \frac{21}{2}$ or 10.5	A1
	$\{\text{At } x=-4,\ y=-8+12=4 \ \text{ or at } x=2,\ y=1+3=4\}$	
	Area of Rectangle $=6\times 4=24$	
	or	M1
	Area of Rectangle**s** $=4\times 4=16$ and $2\times 4=8$	
	Evidence of $(4--2)\times$ their y_{-4} **or** $(4--2)\times$ their y_2	
	or	
	Evidence of $4\times$ their y_{-4} **and** $2\times$ their y_2	
	So, $\text{area(R)}=24-\frac{21}{2}=\frac{27}{2}$	dddM1A1
		(7 marks)

Question	Scheme	Marks
6	$\frac{\mathrm{d}y}{\mathrm{d}x} = 6x^{-\frac{1}{2}} + x\sqrt{x}$	
	$x\sqrt{x} = x^{\frac{3}{2}}$	B1
	$x^n \to x^{n+1}$	M1
	$y = \frac{6}{\frac{1}{2}}x^{\frac{1}{2}} + \frac{x^{\frac{5}{2}}}{\frac{5}{2}}(+c)$	A1 A1
	Use x =4, y =37 to give equation in c , $37 = 12\sqrt{4} + \frac{2}{5}(\sqrt{4})^5 + c$	M1
	$\Rightarrow c = \frac{1}{5}$ or equivalent eg. 0.2	A1
	$(y) = 12x^{\frac{1}{2}} + \frac{2}{5}x^{\frac{5}{2}} + \frac{1}{5}$	A1
		(7 marks)
7	$[\mathrm{f}(x) =]\frac{3x^3}{3} - \frac{3x^2}{2} + 5x[+c]$ <u>or</u> $\left\{x^3 - \frac{3}{2}x^2 + 5x(+c)\right\}$	M1A1
	10 = 8 – 6 + 10 + c	M1
	c = -2	A1
	f(1) = $1 - \frac{3}{2} + 5$ $"-2"$ = $\underline{\frac{5}{2}}$ (o.e.)	A1ft
		(5 marks)

Question	Scheme	Marks
8(a)	$\mathrm{f}(x)=\int\left(\frac{3}{8}x^2-10x^{-\frac{1}{2}}+1\right)\mathrm{d}x$	
	$x^n \to x^{n+1} \Rightarrow \mathrm{f}(x)=\frac{3}{8}\times\frac{x^3}{3}-10\frac{x^{\frac{1}{2}}}{\frac{1}{2}}+x(+c)$	M1, A1, A1
	Substitute $x = 4$, $y = 25$ $\Rightarrow 25 = 8 - 40 + 4 + c \Rightarrow c =$	M1
	$(\mathrm{f}(x))=\frac{x^3}{8}-20x^{\frac{1}{2}}+x+53$	A1
		(5)
8(b)	Sub $x = 4$ into $\mathrm{f}'(x)=\frac{3}{8}x^2-10x^{-\frac{1}{2}}+1$	M1
	$\Rightarrow \mathrm{f}'(4)=\frac{3}{8}\times4^2-10\times4^{-\frac{1}{2}}+1$	
	$\Rightarrow \mathrm{f}'(4)=2$	A1
	Gradient of tangent $= 2 \Rightarrow$ Gradient of normal is $-1/2$	dM1
	Substitute $x = 4$, $y = 25$ into line equation with their changed gradient	
	e.g. $y-25=-\frac{1}{2}(x-4)$	dM1
	$\pm k(2y+x-54)=0$ o.e. (but must have integer coefficients)	A1cso
		(5)
		(10 marks)

Question	Scheme	Marks
9(a)	$\mathrm{f}'(4) = 30 + \dfrac{6-5\times 4^2}{\sqrt{4}}$	M1
	$\mathrm{f}'(4) = -7$	A1
	$y-(-8) = "-7"\times(x-4)$ or $y = "-7"x + c \Rightarrow -8 = "-7"\times 4 + c$ $\Rightarrow c = \ldots$	M1
	$y = -7x + 20$	A1
		(4)
9(b)	**Allow the marks in (b) to score in (a) i.e. <u>mark (a) and (b) together</u>**	
	$\Rightarrow \mathrm{f}(x) = 30x + 6\dfrac{x^{\frac{1}{2}}}{0.5} - 5\dfrac{x^{\frac{5}{2}}}{2.5}(+c)$	M1A1A1
	$x = 4, \mathrm{f}(x) = -8 \Rightarrow$ $-8 = 120 + 24 - 64 + c \Rightarrow c = \ldots$	M1
	$\Rightarrow (\mathrm{f}(x) =) 30x + 12x^{\frac{1}{2}} - 2x^{\frac{5}{2}} - 88$	A1
		(5)
		(9 marks)
10(a)	$\mathrm{f}(x) = x^{\frac{3}{2}} - \dfrac{9}{2}x^{\frac{1}{2}} + 2x(+c)$	M1 A1 A1
	Sub $x = 4, y = 9$ into $\mathrm{f}(x) \Rightarrow c = \ldots$	M1
	$(\mathrm{f}(x) =) x^{\frac{3}{2}} - \dfrac{9}{2}x^{\frac{1}{2}} + 2x + 2$	A1
		(5)
10(b)	Gradient of normal is $-\dfrac{1}{2} \Rightarrow$	M1
	Gradient of tangent = +2	A1
	$\dfrac{3\sqrt{x}}{2} - \dfrac{9}{4\sqrt{x}} + 2 = 2 \Rightarrow \dfrac{3\sqrt{x}}{2} - \dfrac{9}{4\sqrt{x}} = 0$	M1
	$\times 4\sqrt{x} \Rightarrow 6x - 9 = 0 \Rightarrow x = ..$	M1
	$x = 1.5$	A1
		(5)
		(10 marks)

<table>
<tr><th>Question</th><th colspan="2">Scheme</th><th>Marks</th></tr>
<tr><td rowspan="5">11(a)</td><td>Puts $10 - x = 10x - x^2 - 8$ and rearranges to give three term quadratic</td><td>Or puts $y = 10(10 - y) - (10 - y)^2 - 8$ and rearranges to give three term quadratic</td><td>M1</td></tr>
<tr><td>Solves their "$x^2 - 11x + 18 = 0$" using acceptable method as in general principles to give x =</td><td>Solves their "$y^2 - 9y + 8 = 0$" using acceptable method as in general principles to give y =</td><td>M1</td></tr>
<tr><td>Obtains x = 2 , x = 9 (may be on diagram or in part (b) in limits)</td><td>Obtains y = 8, y = 1 (may be on diagram)</td><td>A1</td></tr>
<tr><td>Substitutes their x into a given equation to give y = (may be on diagram)</td><td>Substitutes their y into a given equation to give x= (may be on diagram or in part (b))</td><td>M1</td></tr>
<tr><td>y = 8, y = 1</td><td>x = 2, x = 9</td><td>A1
(5)</td></tr>
<tr><td rowspan="5">11(b)</td><td colspan="2">$\int (10x - x^2 - 8)\,dx = \frac{10x^2}{2} - \frac{x^3}{3} - 8x \{+c\}$</td><td>M1 A1 A1</td></tr>
<tr><td colspan="2">$\left[\frac{10x^2}{2} - \frac{x^3}{3} - 8x\right]_2^9 = (......) - (......)$

$= 90 - \frac{4}{3} = 88\frac{2}{3}$ or $\frac{266}{3}$</td><td>dM1</td></tr>
<tr><td colspan="2">$\text{Area of trapezium} = \frac{1}{2}(8+1)(9-2) = 31.5$</td><td>B1</td></tr>
<tr><td colspan="2">So area of R is $88\frac{2}{3} - 31.5 = 57\frac{1}{6}$ or $\frac{343}{6}$</td><td>M1A1
cao
(7)</td></tr>
<tr><td colspan="2"></td><td></td></tr>
<tr><td></td><td colspan="2"></td><td>(12 marks)</td></tr>
</table>

Question	Scheme	Marks
12(a)	May mark (a) and (b) together Expands to give $10x^{\frac{3}{2}} - 20x$ Integrates to give $\frac{10}{"\frac{5}{2}"}x^{"\frac{5}{2}"} + \frac{-"20"x^2}{2}$ (+ c) Simplifies to $4x^{\frac{5}{2}} - 10x^2$ (+ c)	B1 M1 A1ft A1cao **(4)**
12(b)	Use limits 0 and 4 either way round on their integrated function (may only see 4 substituted) Use limits 4 and 9 either way round on their integrated function Obtains either $\pm$ –32 or $\pm$ 194 needs at least one of the previous M marks for this to be awarded (So area = $\left\|\int_0^4 ydx\right\| + \int_4^9 ydx$) i.e. 32 + 194, = 226	M1 dM1 A1 ddM1 A1 **(5)**
		(9 marks)

AS and A level Mathematics Practice Paper – Integration – Mark scheme

Question	Scheme	Marks
13(a)	Seeing -4 and 2.	B1 **(1)**
13(b)	$x(x+4)(x-2) = \underline{x^3 + 2x^2 - 8x}$ or $\underline{x^3 - 2x^2 + 4x^2 - 8x}$ (without simplifying) $\int (x^3 + 2x^2 - 8x)\,dx = \frac{x^4}{4} + \frac{2x^3}{3} - \frac{8x^2}{2}\{+c\}$ or $\frac{x^4}{4} + \frac{2x^3}{3} - \frac{8x^2}{2}\{+c\}$ $\left[\frac{x^4}{4} + \frac{2x^3}{3} - \frac{8x^2}{2}\right]_{-4}^{0} = (0) - \left(64 - \frac{128}{3} - 64\right)$ **or** $\left[\frac{x^4}{4} + \frac{2x^3}{3} - \frac{8x^2}{2}\right]_{0}^{2} = \left(4 + \frac{16}{3} - 16\right) - (0)$ One integral $= \pm\ 42\frac{2}{3}$ (42.6 or awrt 42.7) **or** other integral $= \pm 6\frac{2}{3}$ (6.6 or awrt 6.7) Hence $\text{Area} = \text{"}their\,42\frac{2}{3}\text{"} + \text{"}their\,6\frac{2}{3}\text{"}$ or $\text{Area} = \text{"}their\,42\frac{2}{3}\text{"} - \text{"}-their\,6\frac{2}{3}\text{"}$ $= 49\frac{1}{3}$ or 49.3 or $\frac{148}{3}$ (NOT $-\frac{148}{3}$) (An answer of $= 49\frac{1}{3}$ may not get the final two marks – check solution carefully)	<u>B1</u> M1A1ft dM1 A1 dM1 A1 **(7)**
		(8 marks)

AS and A level Mathematics Practice Paper – Integration – Mark scheme

Question	Scheme	Marks
14(a)	$\left\{\int\left(3x - x^{\frac{3}{2}}\right)\mathrm{d}x\right\} = \dfrac{3x^2}{2} - \dfrac{x^{\frac{5}{2}}}{\left(\frac{5}{2}\right)} \{+c\}$	M1 A1 A1 **(3)**
14(b)	$0 = 3x - x^{\frac{3}{2}} \Rightarrow 0 = 3 - x^{\frac{1}{2}}$ or $0 = x\left(3 - x^{\frac{1}{2}}\right) \Rightarrow x = \ldots$ $\left\{\text{Area}(S) = \left[\dfrac{3x^2}{2} - \dfrac{2}{5}x^{\frac{5}{2}}\right]_0^9\right\}$ $= \left(\dfrac{3(9)^2}{2} - \left(\dfrac{2}{5}\right)(9)^{\frac{5}{2}}\right) - \{0\}$ $\left\{= \left(\dfrac{243}{2} - \dfrac{486}{5}\right) - \{0\}\right\} = \dfrac{243}{10}$ or 24.3	M1 ddM1 A1 oe **(3)**
		(6 marks)

EDEXCEL CORE MATHEMATICS C1 (6663) – MAY 2017 FINAL MARK SCHEME

	Source paper	Question number	New spec references	Question description
1	C1 2012	1	8.1 and 8.2	Integration
2	C1 2016	1	8.2 and note to 8.1	Integration
3	C1 2017	1	8.2	Integration
4	C2 2014	4	8.2 and 8.3	Integration
5	C2 June 2014R	6	8.3	Integration
6	C1 June 2014R	8	8.1, 8.2 and 8.3	Integration
7	C1 Jan 2012	7	8.1 and 8.2	Integration
8	C1 2014	10	7.3, 8.1 and 8.2	Integration, application of differentiation
9	C1 2017	7	2.1, 3.1, 7.1, 7.3, 8.1, 8.2	Integration, tangent
10	C1 2015	10	7.3, 8.1, 8.2	Integration, tangent/normal problem
11	C2 2012	5	2.4, 8.2 and 8.3	Integration
12	C2 2015	6	8.2 and 8.3	Integration
13	C2 2013	6	8.2 and 8.3	Integration
14	C2 2016	7	8.2 and 8.3	Integration, areas

AS and A level Mathematics Practice Paper – Trigonometry – Mark scheme

Question	Scheme		Marks
1	$\cos^{-1}(-0.4) = 113.58\ (\alpha)$	Awrt 114	B1
	$3x-10=\alpha \Rightarrow x=\dfrac{\alpha+10}{3}$	Uses their α to find *x*. Allow $x=\dfrac{\alpha\pm10}{3}$ **not** $\dfrac{\alpha}{3}\pm10$	M1
	$x=41.2$		A1
	$(3x-10=)360-\alpha\ \ (246.4....)$	$360-\alpha$ (can be implied by 246.4...)	M1
	$x = 85.5$		A1
	$(3x-10=)360+\alpha\ (=473.57....)$	$360+\alpha$ (Can be implied by 473.57...)	M1
	$x = 161.2$		A1
			(7 marks)
2(a)	Way 1	Way 2	
	$1-\sin^2 x = 8\sin^2 x - 6\sin x$	$2=(3\sin x-1)^2$ gives $9\sin^2 x-6\sin x+1=2$ so $\sin^2 x+8\sin^2 x-6\sin x+1=2$	B1
	E.g. $9\sin^2 x-6\sin x=1$ or $9\sin^2 x-6\sin x-1=0$ or $9\sin^2 x-6\sin x+1=2$	so $8\sin^2 x-6\sin x=1-\sin^2 x$	M1
	So $9\sin^2 x-6\sin x+1=2$ or $(3\sin x-1)^2-2=0$ so $(3\sin x-1)^2=2$ or $2=(3\sin x-1)^2$ *	$8\sin^2 x-6\sin x=\cos^2 x$ *	A1cso*
			(3)
2(b)	Way 1: $(3\sin x-1)=(\pm)\sqrt{2}$	Way 2: Expands $(3\sin x-1)^2=2$ and uses quadratic formula on 3TQ	M1
	$\sin x=\dfrac{1\pm\sqrt{2}}{3}$ or awrt 0.8047 **and** awrt -0.1381		A1
	x = 53.58 , 126.42 (or 126.41), 352.06, 187.94		dM1A1 A1
			(5)

Question	Scheme	Marks
		(8 marks)

AS and A level Mathematics Practice Paper – Trigonometry – Mark scheme

Question	Scheme		Marks
3(a)	States or uses $\tan 2x = \dfrac{\sin 2x}{\cos 2x}$		M1
	$\dfrac{\sin 2x}{\cos 2x} = 5\sin 2x \Rightarrow \sin 2x - 5\sin 2x\cos 2x = 0 \Rightarrow \sin 2x(1-5\cos 2x) = 0$		A1
			(2)
3(b)	$\sin 2x = 0$ gives $2x = 0, 180, 360$ so $x = 0, 90, 180$	B1 for two correct answers, second B1 for all three correct. Excess in range – lose last B1	B1B1
	$\cos 2x = \frac{1}{5}$ gives $2x = 78.46$ (or 78.5 or 78.4) **or** $2x = 281.54$ (or 281.6)		M1
	$x = 39.2$ (or 39.3), 140.8 (or 141)		A1A1
			(5)
			(7 marks)
4(a)	$3\sin^2 x + 7\sin x = \cos^2 x - 4$; $0 \leq x < 360°$		
	$3\sin^2 x + 7\sin x = (1 - \sin^2 x) - 4$		M1
	$4\sin^2 x + 7\sin x + 3 = 0$ **AG**		A1* cso
			(2)
4(b)	$(4\sin x + 3)(\sin x + 1)$ {= 0}		
	$\sin x = \dfrac{3}{4}$, $\sin x = -1$		
	($\lvert\alpha\rvert = 48.59\ldots$)		
	$x = 180 + 48.59$ or $x = 360 - 48.59$		
	$x = 228.59\ldots$ or $x = 311.41\ldots$		
	{$\sin x = -1$} $\Rightarrow x = 270$		
	Valid attempt at factorization and $\sin x = \ldots$		M1
	Both $\sin x = \dfrac{3}{4}$ and $\sin x = -1$		A1
	Either $(180 + \lvert\alpha\rvert)$ or $(180 - \lvert\alpha\rvert)$		dM1
	Both awrt 228.6 and awrt $x = 311.4$		A1
	270		B1
			(5)
			(7 marks)

Question	Scheme	Marks
5(a)	(i) $9\sin(\theta+60^\circ)=4;\ \ 0\le\theta<360^\circ$ (ii) $2\tan x-3\sin x=0;\ -\pi\le x<\pi$	
	$\sin(\theta+60^\circ)=\frac{4}{9}$, so $(\theta+60^\circ)=26.3877...$	M1
	$(\alpha=26.3877...)$	
	So, $\theta+60^\circ=\{153.6122...,\ 386.3877...\}$	M1
	and $\theta=\{93.6122...,\ 326.3877...\}$	A1 A1
	Both answers are cso and must come from correct work	
		(4)
5(b)	$2\left(\frac{\sin x}{\cos x}\right)-3\sin x=0$	M1
	$2\sin x-3\sin x\cos x=0$	
	$\sin x(2-3\cos x)=0$	
	$\cos x=\frac{2}{3}$	A1
	$x=\text{awrt}\{0.84,-0.84\}$	A1A1ft
	$\{\sin x=0\Rightarrow\}\ x=0$ **and** $-\pi$	B1
		(5)
		(9 marks)

AS and A level Mathematics Practice Paper – Trigonometry – Mark scheme

Question	Scheme	Marks
6(i)	$\left(\lvert\alpha\rvert = 56.3099...\right)$	
	$x = \{\alpha + 40 = 96.309993...\} = $ **awrt 96.3**	B1
	$x - 40^\circ = -180 + "56.3099"...$ or $x - 40^\circ = -\pi + "0.983"...$	M1
	$x = \{-180 + 56.3099... + 40 = -83.6901...\} = $ **awrt -83.7**	A1
		(3)
6(ii)(a)	$\sin\theta\left(\dfrac{\sin\theta}{\cos\theta}\right) = 3\cos\theta + 2$	M1
	$\left(\dfrac{1-\cos^2\theta}{\cos\theta}\right) = 3\cos\theta + 2$	dM1
	$1-\cos^2\theta = 3\cos^2\theta + 2\cos\theta \Rightarrow 0 = 4\cos^2\theta + 2\cos\theta - 1$ *	A1 cso *
		(3)
6(ii)(b)	$\cos\theta = \dfrac{-2 \pm \sqrt{4 - 4(4)(-1)}}{8}$ **or** $4(\cos\theta \pm \frac{1}{4})^2 \pm q \pm 1 = 0$, or $(2\cos\theta \pm \frac{1}{2})^2 \pm q \pm 1 = 0$, $q \neq 0$ so $\cos\theta = ...$	M1
	One solution is 72^o or 144^o, Two solutions are 72^o and 144^o	A1A1
	$\theta = \{72, 144, 216, 288\}$	M1A1
		(5)
		(11 marks)

EDEXCEL CORE MATHEMATICS C1 (6663) – MAY 2017 FINAL MARK SCHEME

	Source paper	Question number	New spec references	Question description
1	C2 Jan 2013	4	5.7	Trigonometry
2	C2 2017	8	5.3 and 5.5	Solving trig equations
3	C2 2012	6	5.5 and 5.7	Trigonometry
4	C2 Jan 2011	7	5.5 and 5.7	Trigonometry
5	C2 2014	7	5.5 and 5.7	Trigonometric equations
6	C2 2013	8	5.5 and 5.7	Trigonometric equations