Write your name here

Surname	Other names

Pearson Edexcel Award

Centre Number	Candidate Number

Algebra

Level 3
Calculator NOT allowed

Thursday 14 January 2016 – Morning **Time: 2 hours**	Paper Reference **AAL30/01**

You must have: Ruler graduated in centimetres and millimetres, pair of compasses, pen, HB pencil, eraser.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators are not allowed.**

Information

- The total mark for this paper is 90
- 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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 4 7 0 9 6 A 0 1 2 4

PEARSON

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

You must NOT use a calculator.

1 (a) Expand and simplify $(p - 1)(p + 1)$

.....

(1)

(b) Expand and simplify $(2q - 1)^2$

.....

(2)

$(5y^2)^{-3}$ can be written in the form ay^n

(c) Find the value of a and the value of n

$a =$ .....

$n =$ .....

(2)

(d) Simplify $\sqrt{64z^4}$

.....

(2)

(e) Simplify $\dfrac{x^2 + 7x - 8}{(x + 8)^2}$

.....

(2)

(Total for Question 1 is 9 marks)

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2 (a) Use the quadratic formula to solve the equation $4x^2 - x - 2 = 0$

Give your solutions in the form $\frac{p \pm \sqrt{q}}{r}$ where p, q and r are integers.

.....

(2)

(b) Write down the solutions of the equation $8x^2 - 2x - 4 = 0$

.....

(1)

(Total for Question 2 is 3 marks)

3 (a) Factorise $15c^3d + 35cd^2 + 20c^2d^2$

.....

(2)

(b) Factorise $ab - 2a - 4b + 8$

.....

(2)

(c) Factorise $3b^2 - 9b - 84$

.....

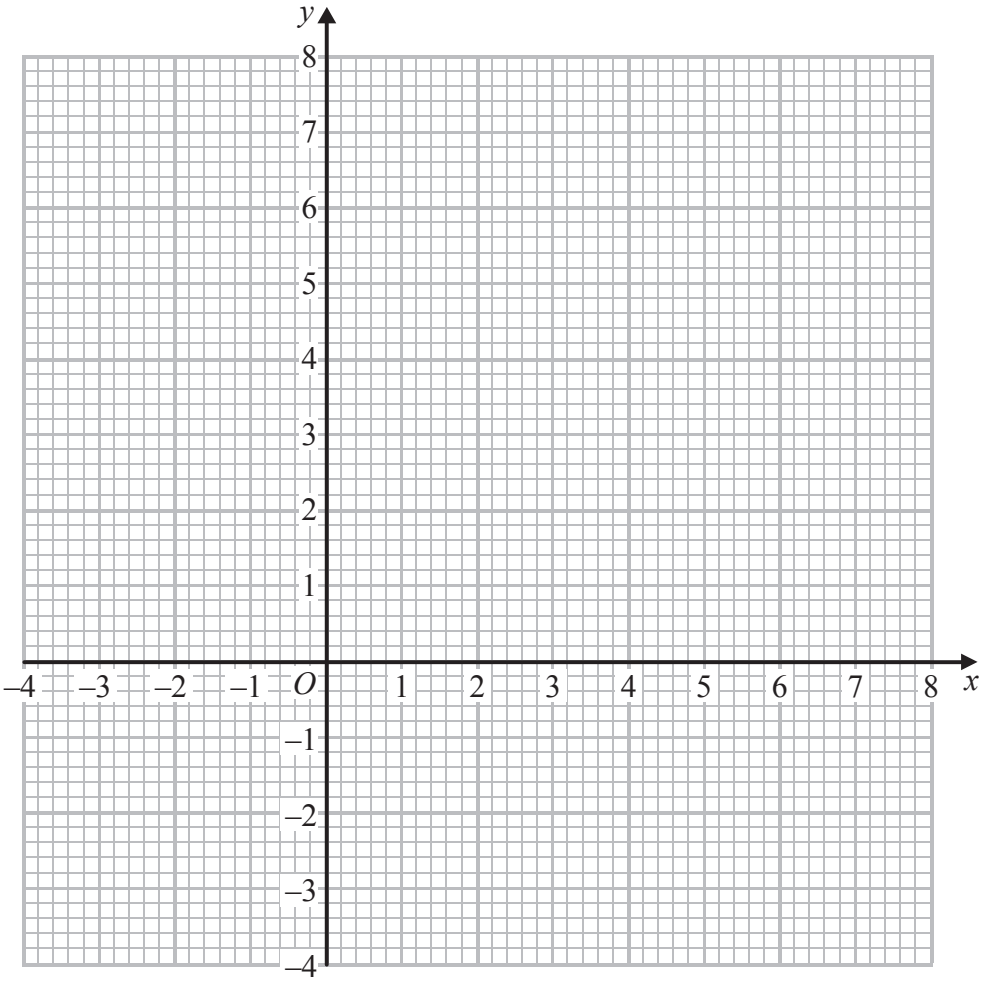
(2)

(Total for Question 3 is 6 marks)

4 On the grid, shade the region that satisfies all these inequalities.

$$x > 0 \qquad x + y < 6 \qquad y > 3x - 3$$

Label the region **R**.



(Total for Question 4 is 4 marks)

5 The straight line $\mathbf{L}_1$ has equation $y = \frac{1}{2}x + 5$

(a) Write the equation of $\mathbf{L}_1$ in the form $ax + by + c = 0$ where a, b and c are integers.

.....

(2)

The straight line $\mathbf{L}_2$ has equation $y = \frac{1}{3}x - 2$

The point A has coordinates (6, 6)

(b) (i) Find an equation of the straight line parallel to $\mathbf{L}_2$ which passes through A.

Give your answer in the form $y = mx + c$

.....

(ii) Find an equation of the straight line perpendicular to $\mathbf{L}_2$ which passes through A.

.....

(4)

(Total for Question 5 is 6 marks)

6 (a) Solve $x^2 < 16$

.....

(1)

(b) Solve $(5 - x)(2 + x) \leqslant 0$

.....

(2)

(Total for Question 6 is 3 marks)

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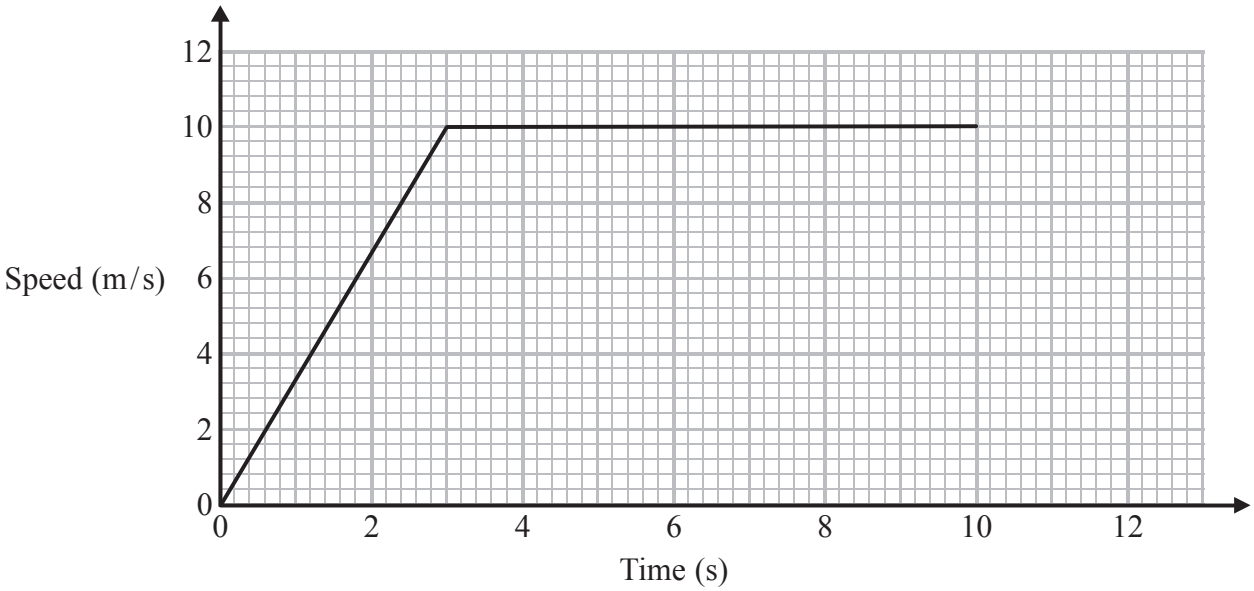
7 Here is a speed-time graph of a runner for the first 10 seconds of a race.



(a) Calculate the acceleration of the runner during the first 3 seconds of the race.
Give your answer in m/s^2.

..... m/s^2

(1)

(b) Calculate how far the runner ran in the first 10 seconds of the race.
Give your answer in metres.

..... m

(3)

After 10 seconds the runner decelerated at a constant rate of 2.5 m/s^2 for 2 seconds.

(c) Show this information on the speed-time graph.

(2)

(Total for Question 7 is 6 marks)

8 Here is a quadratic equation.

$$2x^2 - 10x - 7 = 0$$

(a) (i) Calculate the discriminant of this equation.

.....

(ii) State what your answer tells you about the roots of the equation $2x^2 - 10x - 7 = 0$

(3)

(b) Write down the sum and the product of the roots of the equation $2x^2 - 10x - 7 = 0$

sum = ...

product = ...

(2)

(Total for Question 8 is 5 marks)

9 $y^2 = \dfrac{x^2}{x^2 + 1}$

(a) Find the exact positive value of y when $x = \dfrac{1}{2}$

.....

(2)

(b) Make x the subject of $y^2 = \dfrac{x^2}{x^2 + 1}$

.....

(3)

(Total for Question 9 is 5 marks)

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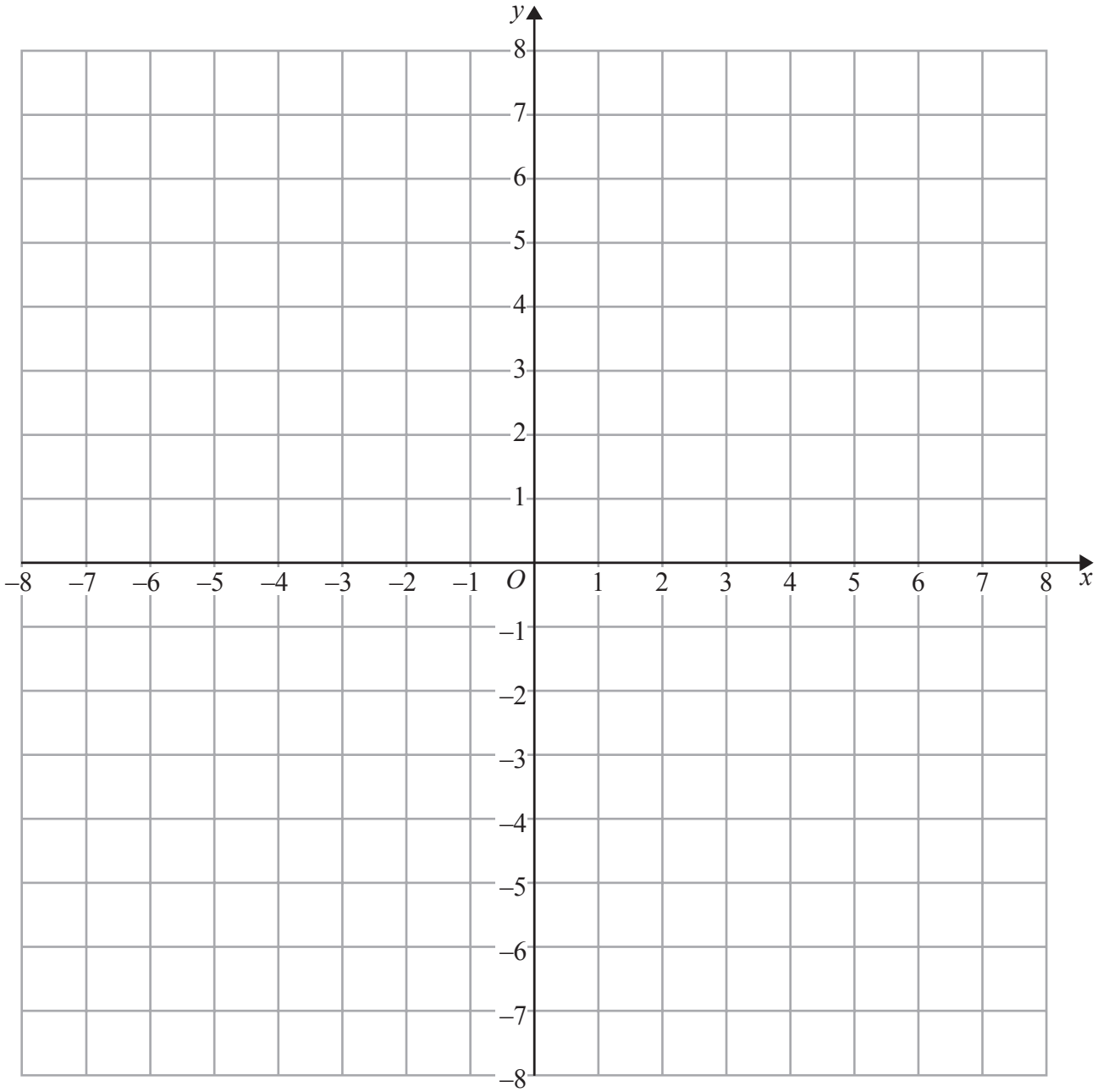
10 On the grid, construct the graph of $4x^2 + 4y^2 = 64$



(Total for Question 10 is 2 marks)

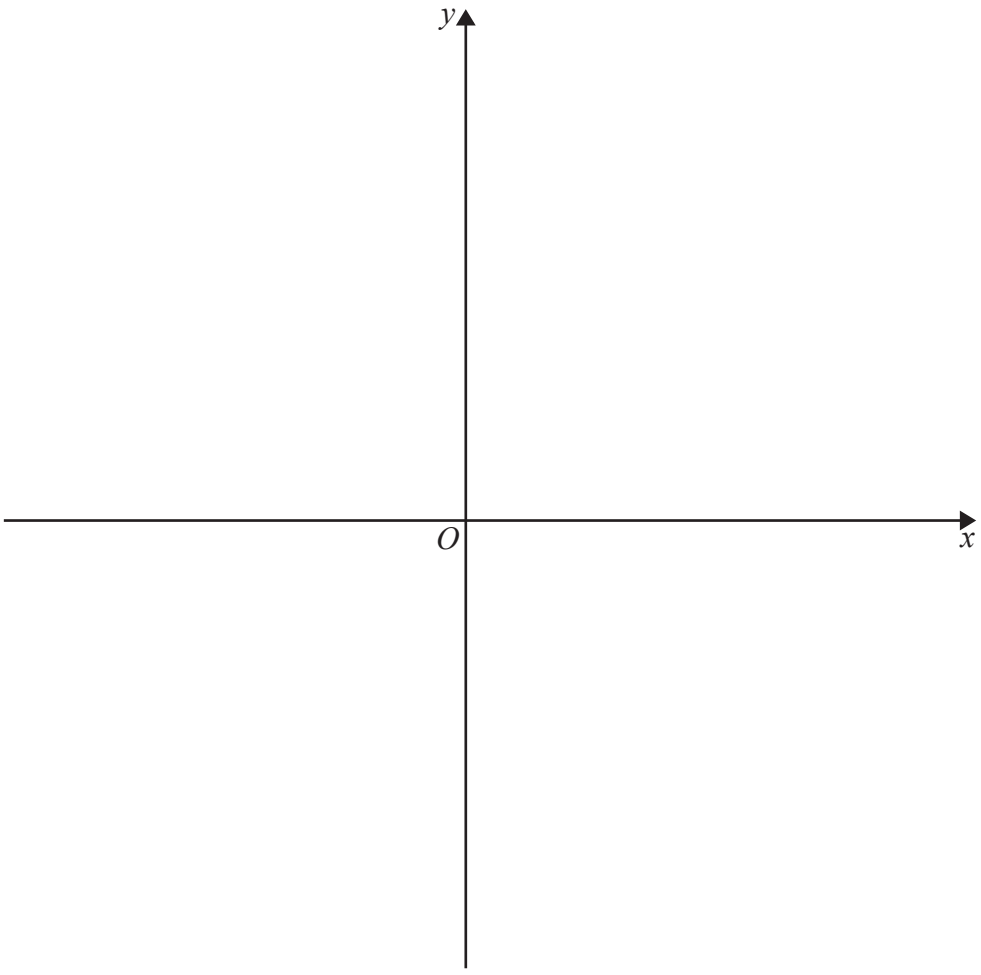
11 (a) Write the quadratic expression $x^2 - 10x + 29$ in the form $(x + p)^2 + q$ where p and q are constants.

.....

(2)

(b) Sketch the graph of $y = x^2 - 10x + 29$

Mark, on your sketch, the coordinates of the turning point of the graph and the coordinates of the point where the graph intersects the y-axis.



(3)

(Total for Question 11 is 5 marks)

12 (a) The first term of an arithmetic series is 100
The common difference of the series is −4

Find an expression, in terms of n, for the nth term of this series.
Give your answer in its simplest form.

.....

(2)

(b) The common difference of a different arithmetic series is 3
The sum of the first 50 terms of this series is 2500

Find the first term of this series.

.....

(3)

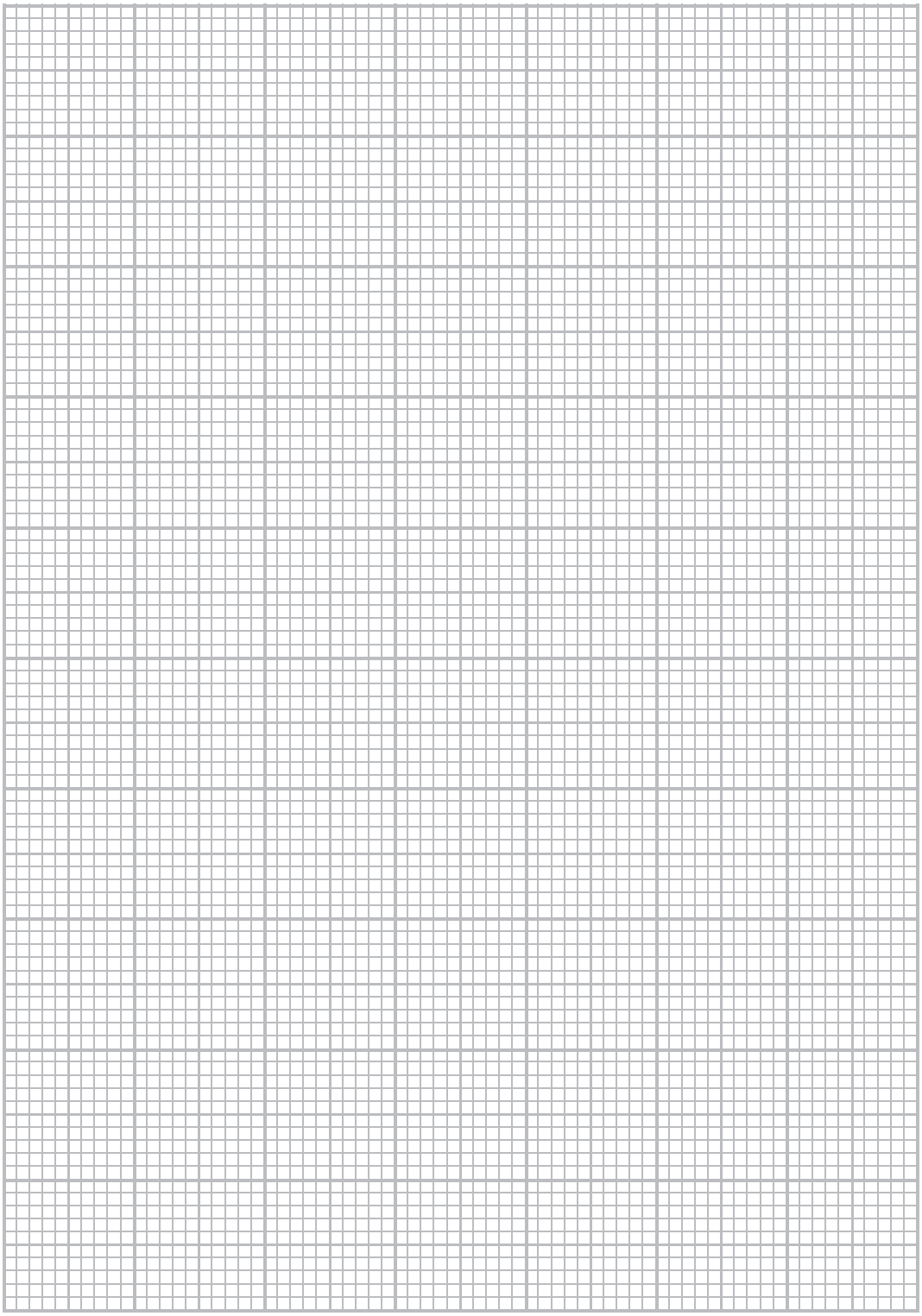
(Total for Question 12 is 5 marks)

13 (a) Complete the table of values for $y = x(x^2 + 1)$

x	−2	−1.5	−1	−0.5	0	0.5	1	1.5	2
y		−4.875			0	0.625		4.875	

(2)

(b) On the grid opposite, draw the graph of $y = x(x^2 + 1)$ for values of x from −2 to 2



(2)

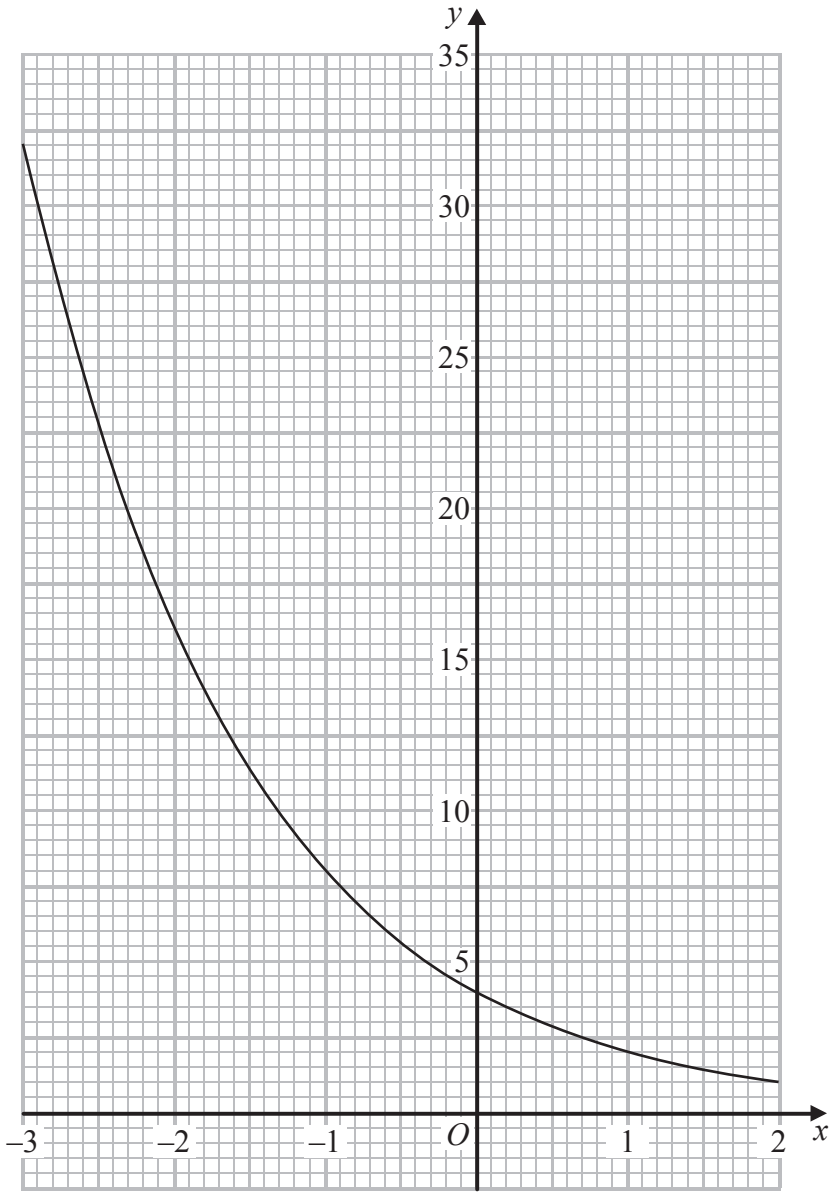
(c) Use your graph to find an estimate, to one decimal place, for the solution of $x^3 + x - 3 = 0$

.....

(2)

(Total for Question 13 is 6 marks)

14 Here is the graph of $y = 4 \times 2^{-x}$ for values of x from -3 to 2



Use the trapezium rule to find the area of the region under the curve, between $x = -3$ and $x = 2$, and above $y = 0$
Use 5 strips of equal width.

(Total for Question 14 is 3 marks)

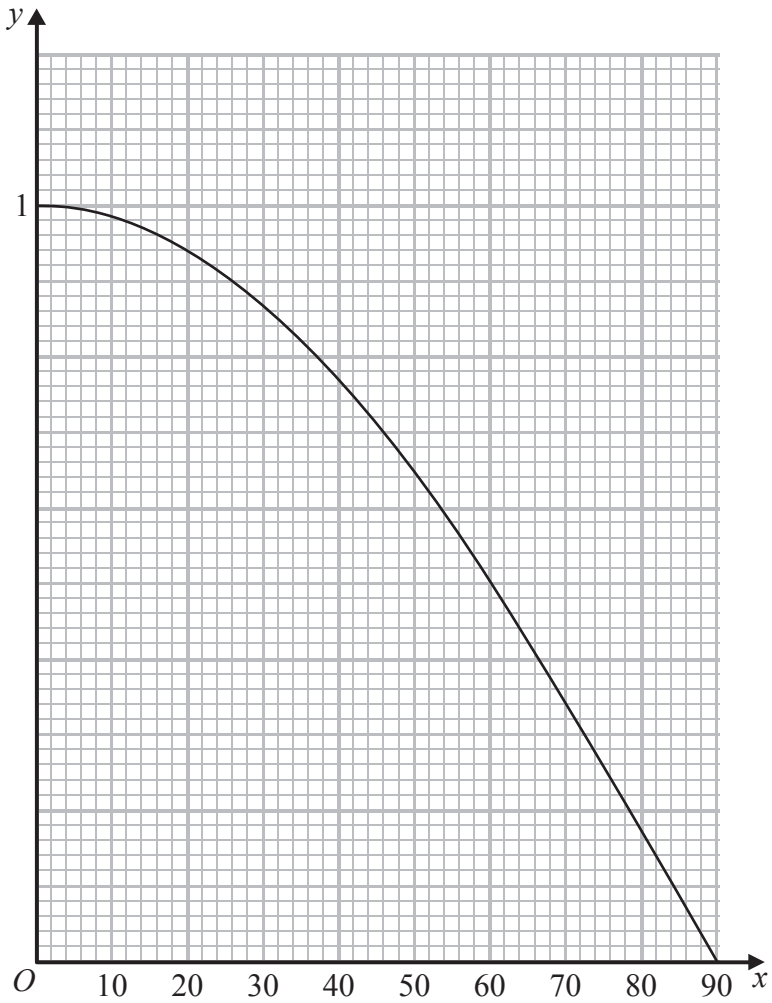
15 Solve, algebraically, the simultaneous equations

$$2x^2 + 2y^2 = 17$$

$$y - x = 4$$

(Total for Question 15 is 4 marks)

16 Here is the graph of $y = \cos x°$ for $0 \leqslant x \leqslant 90$

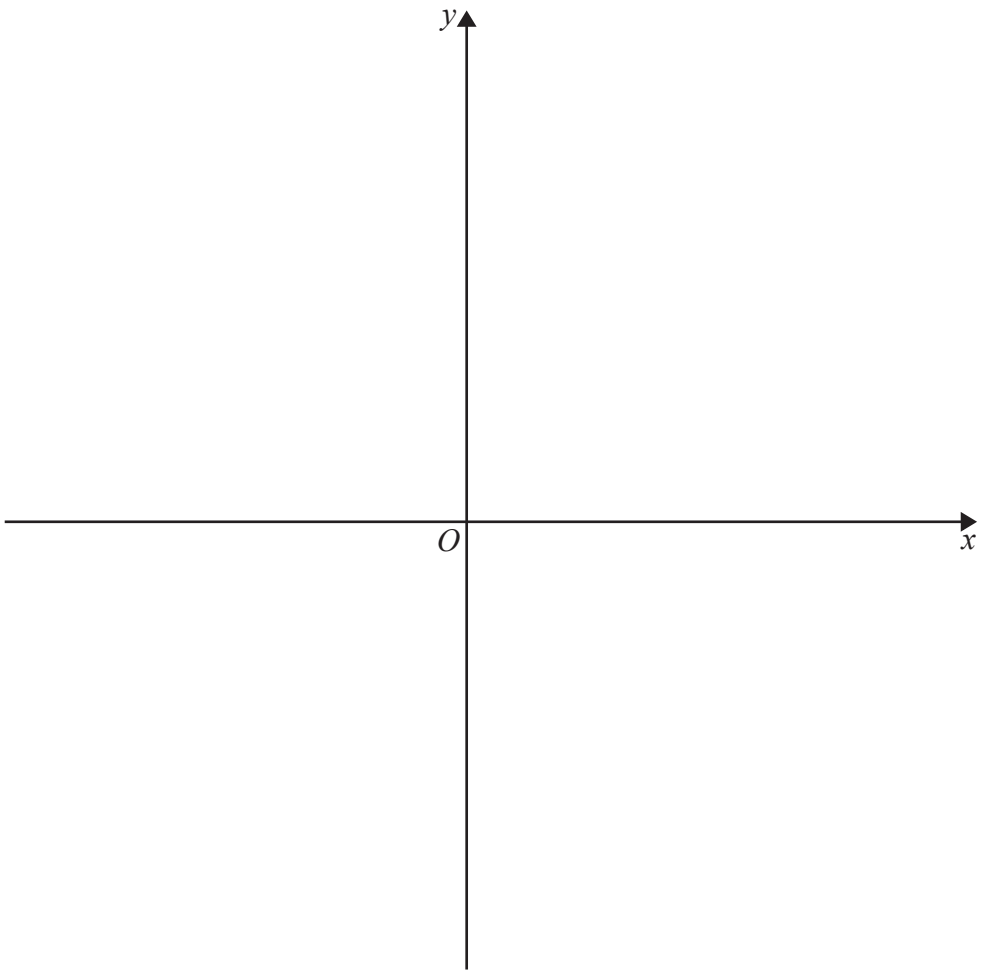


(i) On the graph, draw the tangent to the curve at the point where $x = 30$
Label the tangent T.

(ii) On the graph, draw the normal to the curve at the point where $x = 30$
Label the normal N.

(Total for Question 16 is 2 marks)

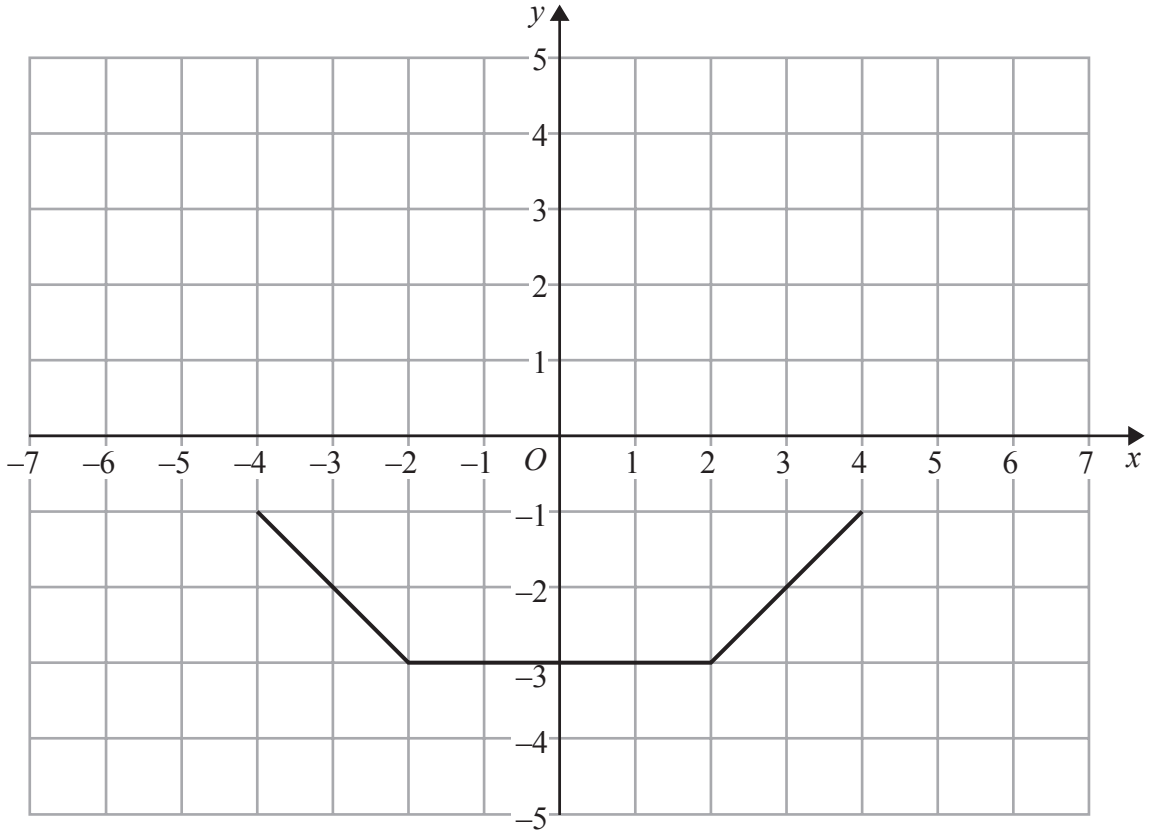
17 Sketch the graph of $y = \dfrac{1}{x - 4}$



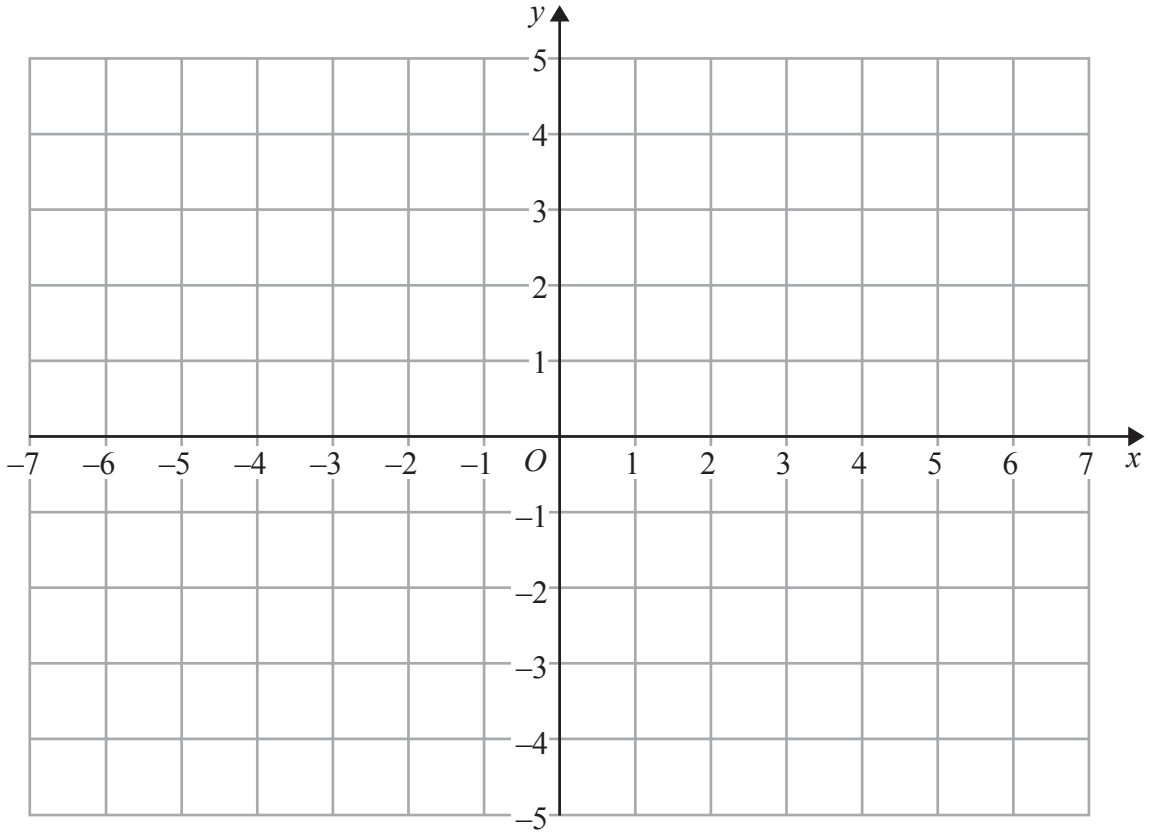
Show clearly any asymptotes and the coordinates of any points of intersection of the graph with the axes.

(Total for Question 17 is 4 marks)

18 Here is the graph of $y = h(x)$

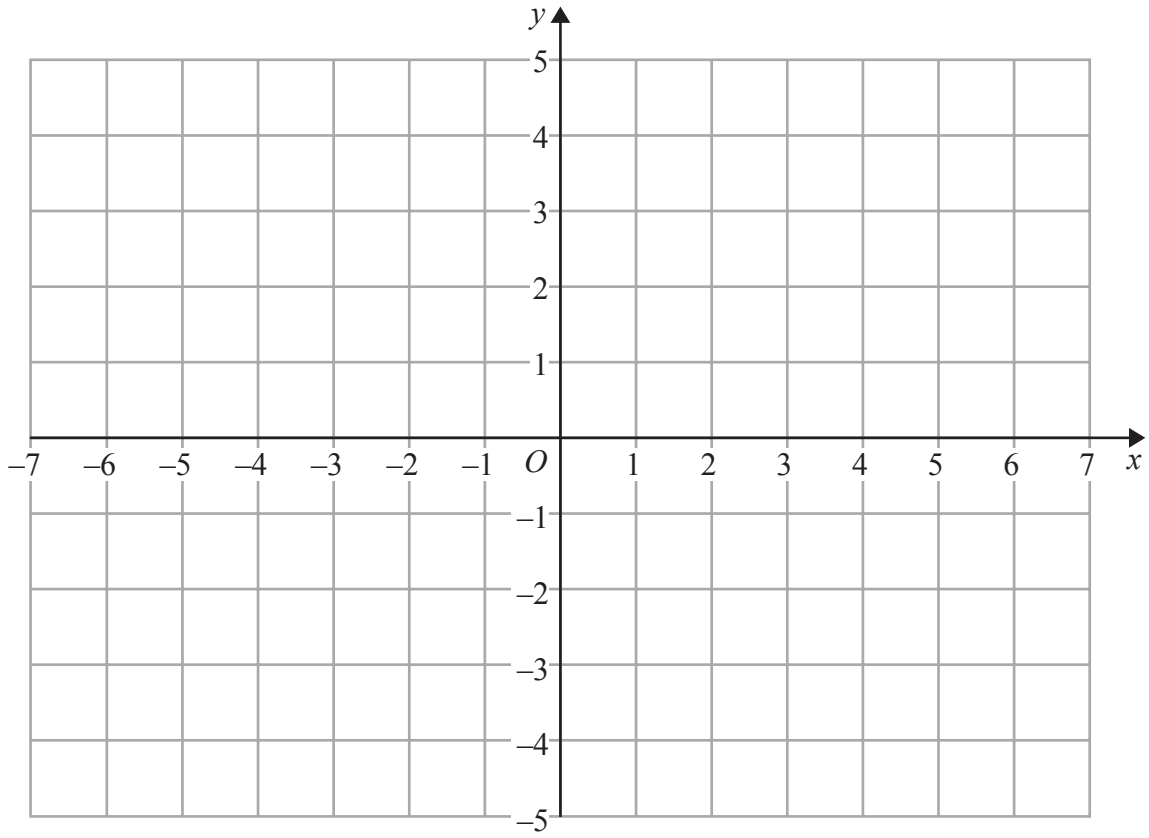


(a) On the grid below, draw the graph of $y = h(x) + 1$



(2)

(b) On the grid below, draw the graph of $y = h(2x)$



(2)

(Total for Question 18 is 4 marks)

19 p is proportional to d^3

When $d = 2$, $p = 48$

Find a formula for p in terms of d

.....

(Total for Question 19 is 2 marks)

20 (a) Rationalise the denominator of $\frac{1}{5\sqrt{3}}$

(2)

(b) (i) Write $\sqrt{18}$ in the form $n\sqrt{2}$ where n is an integer.

(ii) Hence express $\frac{1}{\sqrt{8}} + \frac{1}{\sqrt{18}}$ as a single fraction.

Give your answer in the form $\frac{a}{b\sqrt{2}}$ where a and b are integers.

(4)

(Total for Question 20 is 6 marks)

TOTAL FOR PAPER IS 90 MARKS

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