**Pearson
Edexcel Award**

Algebra

**Level 3
Calculator NOT allowed**

Thursday 12 January 2017 – Morning	Paper Reference
Time: 2 hours	**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 ▶

Pearson

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

You must NOT use a calculator.

1 (a) Factorise $d^2 - d - 12$

....

(1)

(b) Factorise $mk + 2k - 3m - 6$

....

(2)

(c) Factorise $2p^4 - 18p^2$

....

(2)

(Total for Question 1 is 5 marks)

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

$$y > \frac{1}{4}x \qquad\qquad y > 3 - x \qquad\qquad x + 3y < 7$$

Label the region **R**.
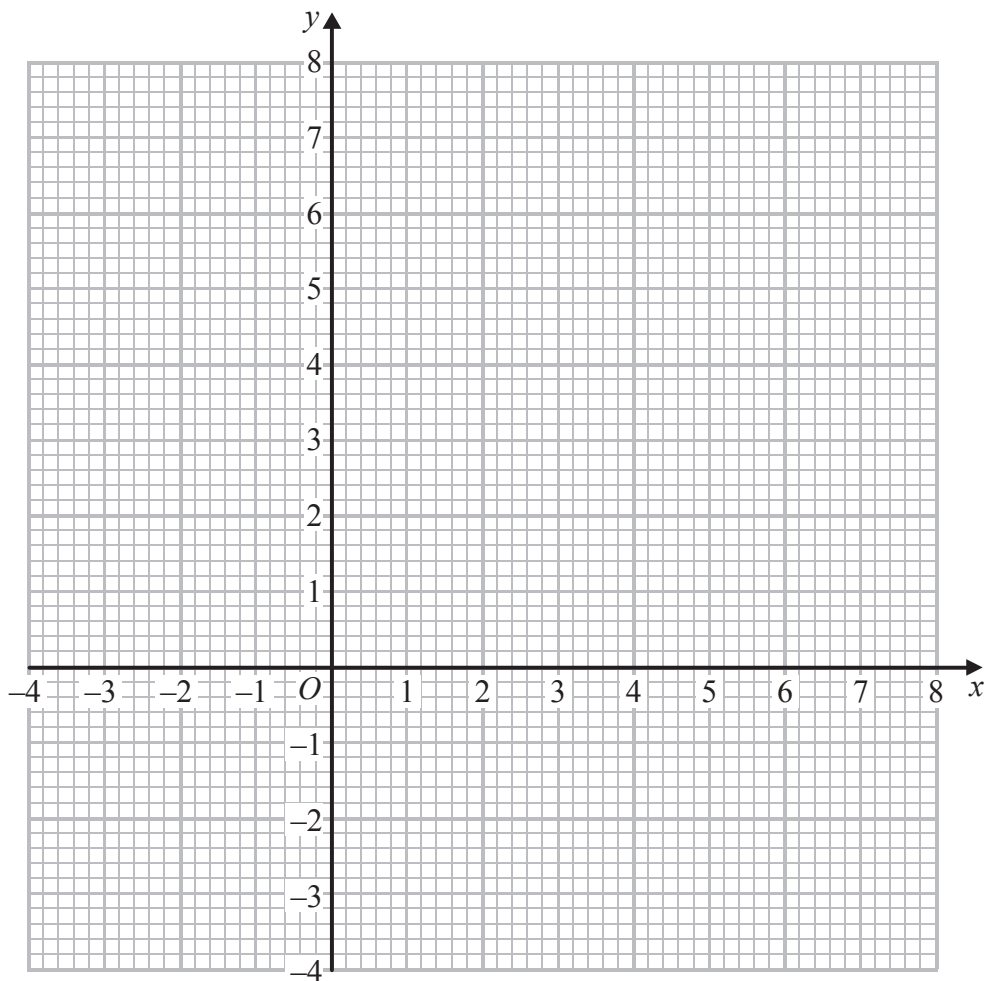
(Total for Question 2 is 5 marks)

3 (a) Simplify $m^{\frac{3}{4}} \times m^{\frac{1}{2}}$

....

(1)

(b) Simplify $n^{-3} \div n^2$

....

(1)

$(4x^6)^{\frac{3}{2}}$ can be written in the form ax^n

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

$a =$ ....

$n =$ ....

(2)

(d) Expand and simplify $(1 - 4y)(5 - y)$

....

(2)

(e) Simplify $\dfrac{u - 2}{u^2 - 4u + 4}$

....

(2)

(Total for Question 3 is 8 marks)

4 (a) Solve the equation $4x(x - 3) = 7$

....

(3)

(b) Use the quadratic formula to solve the equation $3x^2 = 1 - 8x$

Give your answer in the form $\dfrac{p \pm \sqrt{q}}{3}$ where p and q are integers.

....

(3)

(Total for Question 4 is 6 marks)

5 The straight line L_1 has equation $5x + 3y = 15$

(a) Write the equation of L_1 in the form $y = mx + c$

....

(1)

The straight line L_2 passes through the origin and is perpendicular to L_1

(b) Find an equation of the straight line L_2

....

(2)

The straight line L_3 is parallel to L_1 and passes through the point with coordinates $(6, 0)$.

(c) Find an equation of the straight line L_3

....

(2)

(Total for Question 5 is 5 marks)

6 $C = 4 + \dfrac{t^2}{100}$

(a) (i) Find the value of C when $t = -10$

....

(ii) Make t the subject of the formula.

....

(4)

(b) (i) Write the quadratic expression $x^2 + 6x + 5$ in the form $(x + p)^2 + q$
where p and q are constants.

....

(ii) Given that $y = x^2 + 6x + 5$
use your answer to (b)(i) to express x in terms of y.

....

(4)

(Total for Question 6 is 8 marks)

7 (a) Complete the table of values for $y = 2^{-x}$

x	−3	−2	−1	0	1	2	3
y							

(2)

(b) On the grid opposite, draw the graph of $y = 2^{-x}$ for values of x from −3 to 3
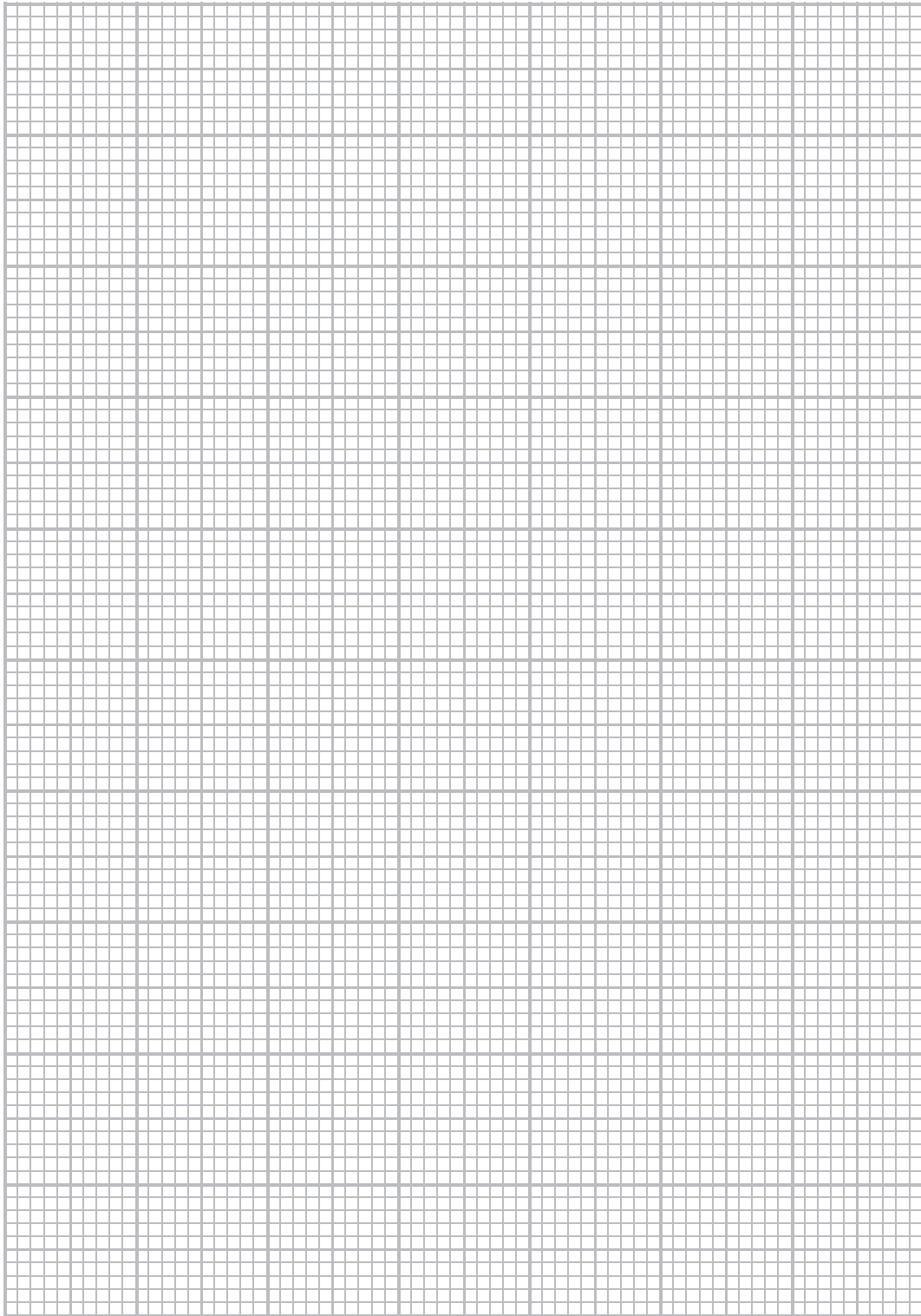
(2)

(c) Use your graph to find an estimate, to one decimal place, for the solution of $2^{-x} - 5 = 0$

....

(2)

(Total for Question 7 is 6 marks)

Turn over ▶

8 The equation $9x^2 + 3x + c = 0$ has two equal roots.

(a) Find the value of c.

....

(2)

For a different quadratic equation,

the sum of its roots is $-\dfrac{7}{4}$

the product of its roots is $-\dfrac{1}{4}$

(b) Find the quadratic equation in the form $ax^2 + bx + c = 0$ where a, b and c are integers.

....

(3)

(Total for Question 8 is 5 marks)

9 A circle has equation $x^2 + y^2 = 49$

Does the point with coordinates (6, 6) lie inside or outside this circle?

Show clearly how you get your answer.
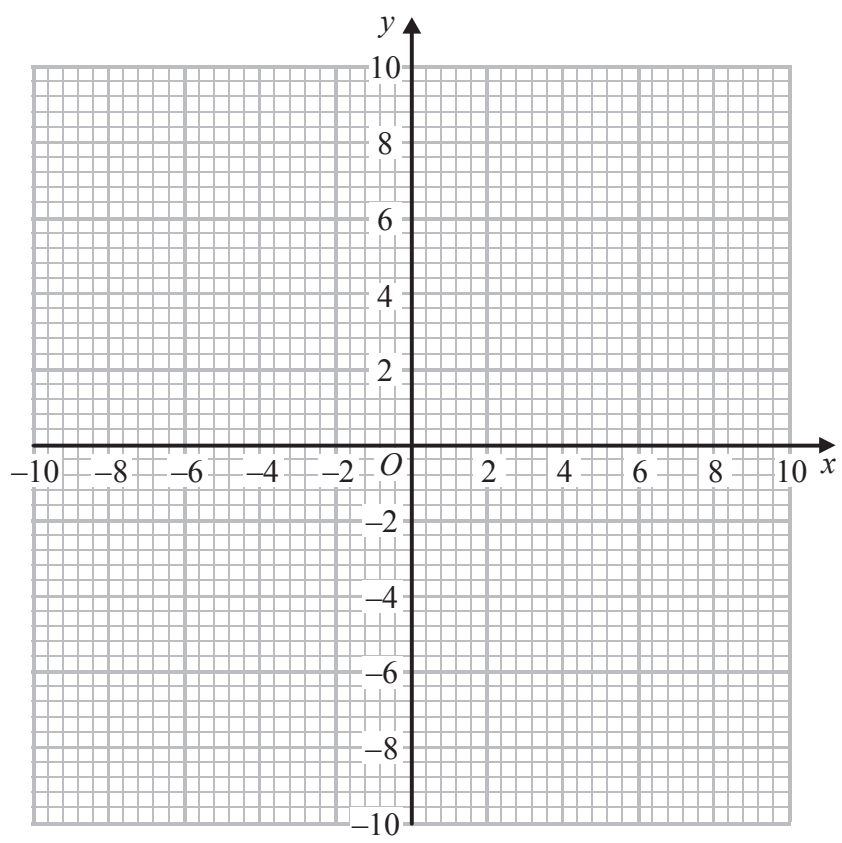
(Total for Question 9 is 2 marks)

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P 4 8 3 3 2 A 0 1 1 2 4

10 (a) Here are the first five terms of an arithmetic series.

$$10 \qquad 13 \qquad 16 \qquad 19 \qquad 22$$

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

....

(2)

(b) The first term of a different arithmetic series is 4
The common difference of this series is 8
The sum of the first n terms of this series is greater than 1000

Find the smallest possible value of n.

....

(3)

(Total for Question 10 is 5 marks)

11 Here is a distance-time graph for a particle.
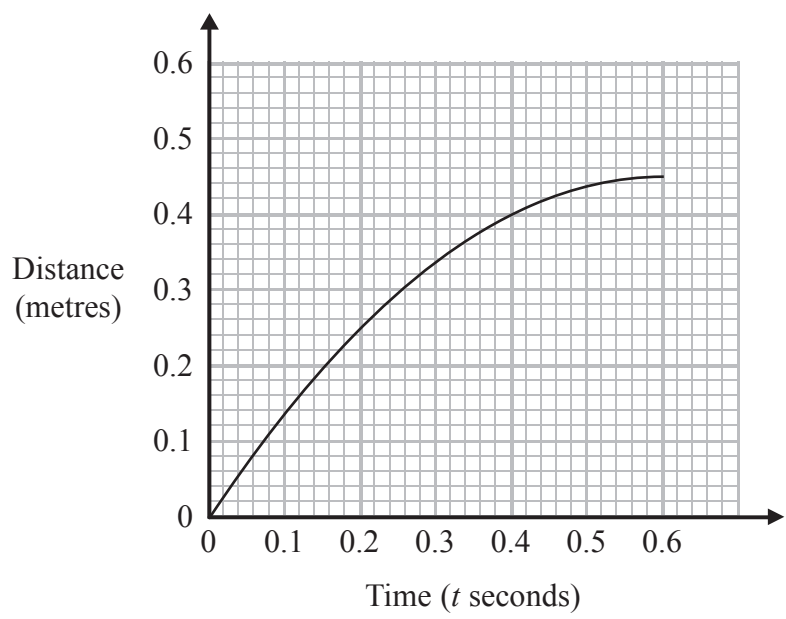
(a) Explain what the gradient of the curve represents.

(1)

(b) Draw a tangent to the curve at $t = 0.3$

(1)

(Total for Question 11 is 2 marks)

P 4 8 3 3 2 A 0 1 3 2 4

12 Here is part of the graph of $y = \dfrac{1}{1 + x}$
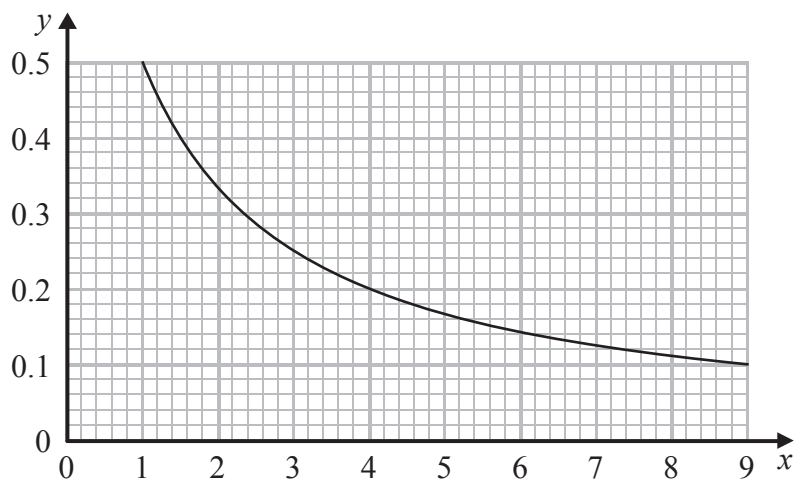
Use the trapezium rule to find an estimate of the area of the region under the curve and between $x = 1$, $y = 0$ and $x = 9$
Use 4 strips of equal width.

....

(Total for Question 12 is 3 marks)

13 (a) Solve $12 - 5x < 2x$

....

(2)

(b) Solve $x^2 + 4x + 3 < 0$

....

(2)

(Total for Question 13 is 4 marks)

14 Sketch the graph of $y = x^3 - 2$
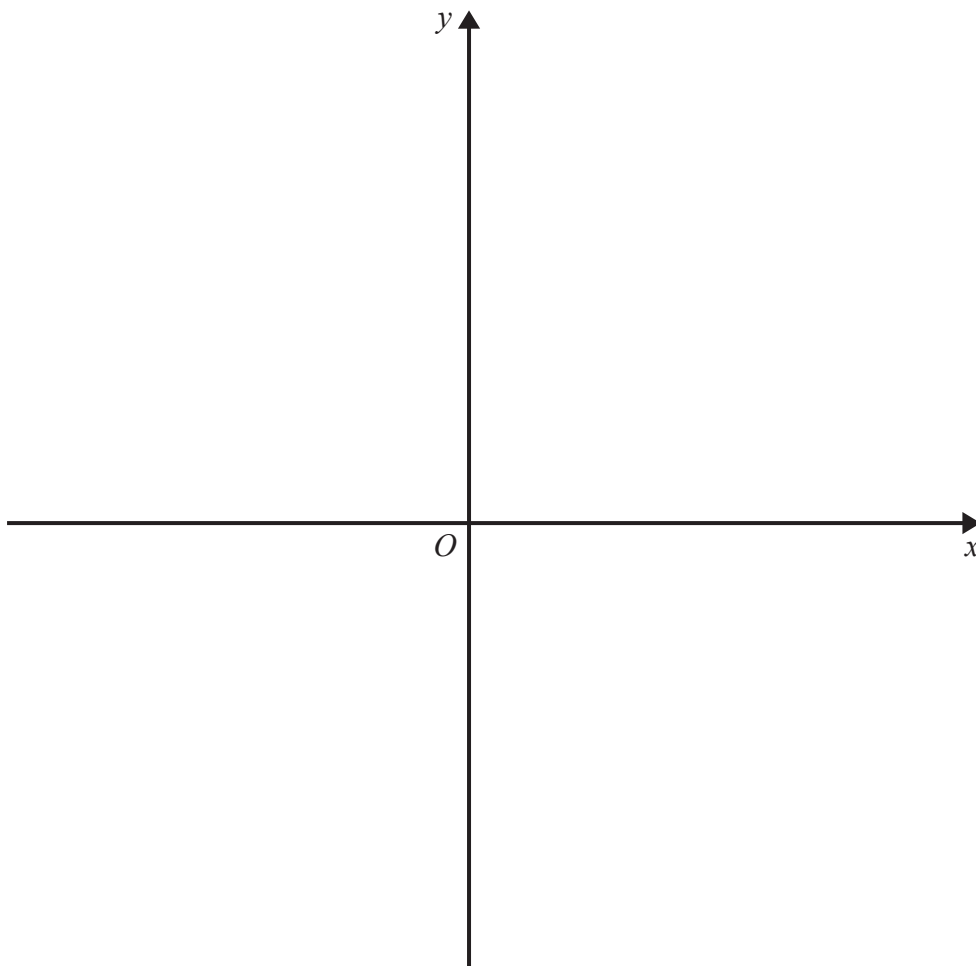
(Total for Question 14 is 3 marks)

15 (a) Rationalise the denominator of $\dfrac{1}{3 + \sqrt{7}}$

....

(2)

(b) (i) Write $(\sqrt{5} + \sqrt{2})^2 - (\sqrt{5} - \sqrt{2})^2$ in the form $a\sqrt{b}$ where a and b are integers.

....

(ii) Hence find the value of $\left[(\sqrt{5} + \sqrt{2})^2 - (\sqrt{5} - \sqrt{2})^2\right]^2$

....

(4)

(Total for Question 15 is 6 marks)

16 A runner accelerates from rest at 2 m/s^2 for 4 seconds, then runs at a constant speed for 5 seconds and then decelerates at 4 m/s^2 until he comes to rest.
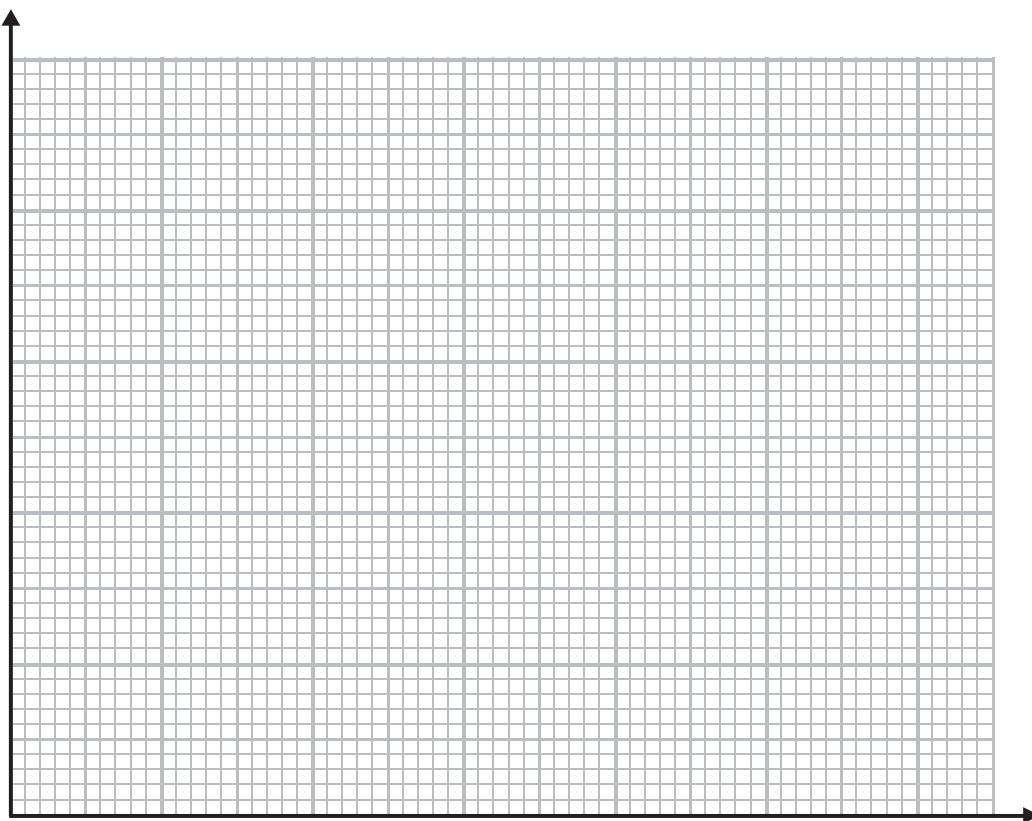
(a) Draw a speed-time graph to show this information.

(4)

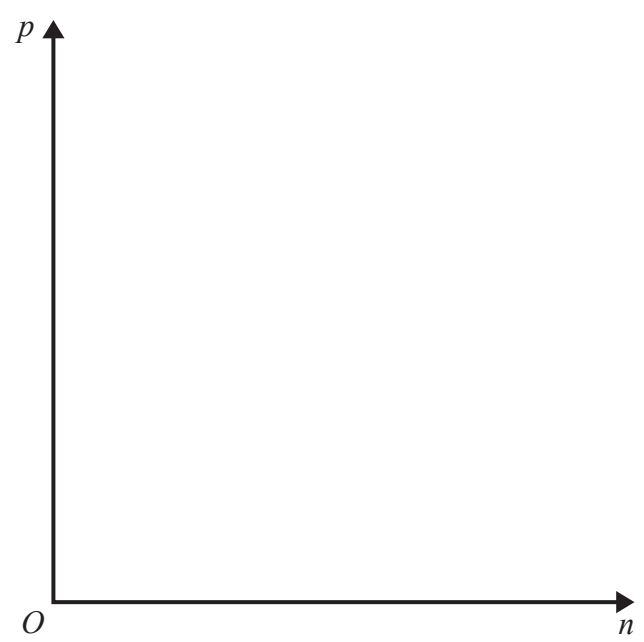(b) Work out the total distance travelled by the runner in the first 3 seconds.

(2)

(Total for Question 16 is 6 marks)

17 p is inversely proportional to the square root of n.

When $n = 36$, $p = 5$

(a) Find a formula for p in terms of n.

....
(3)

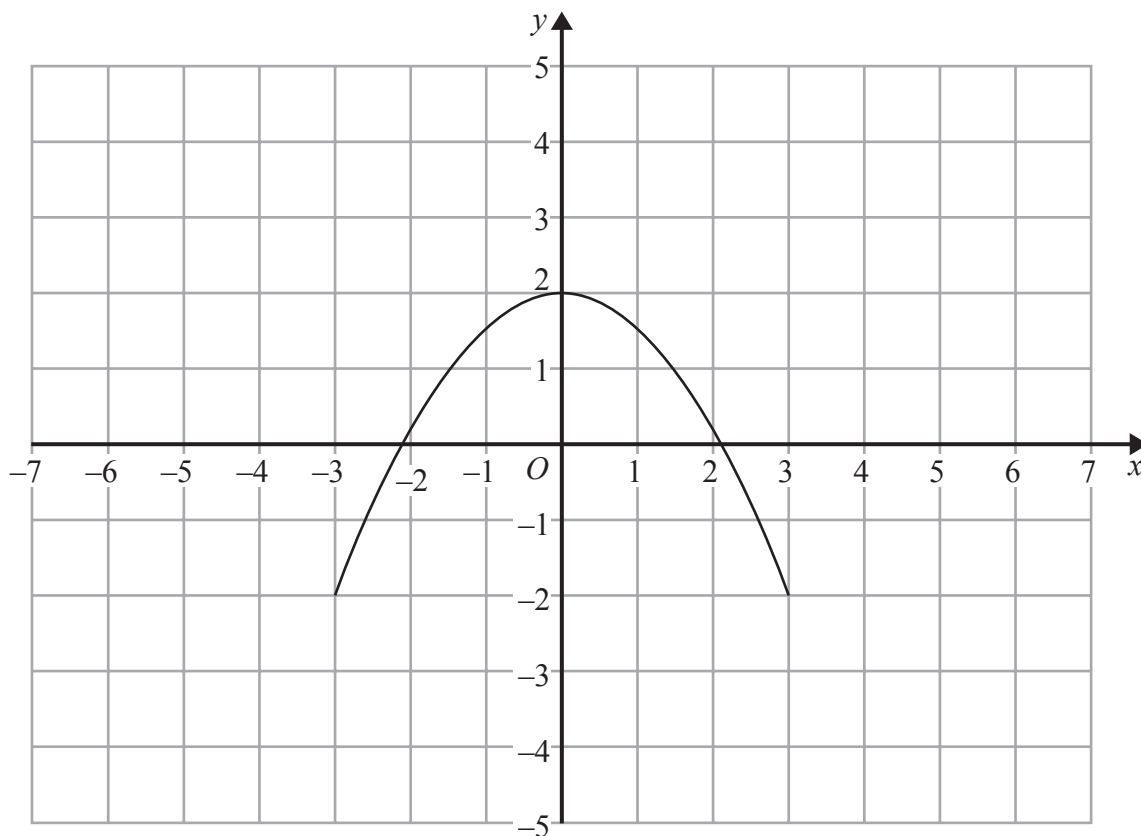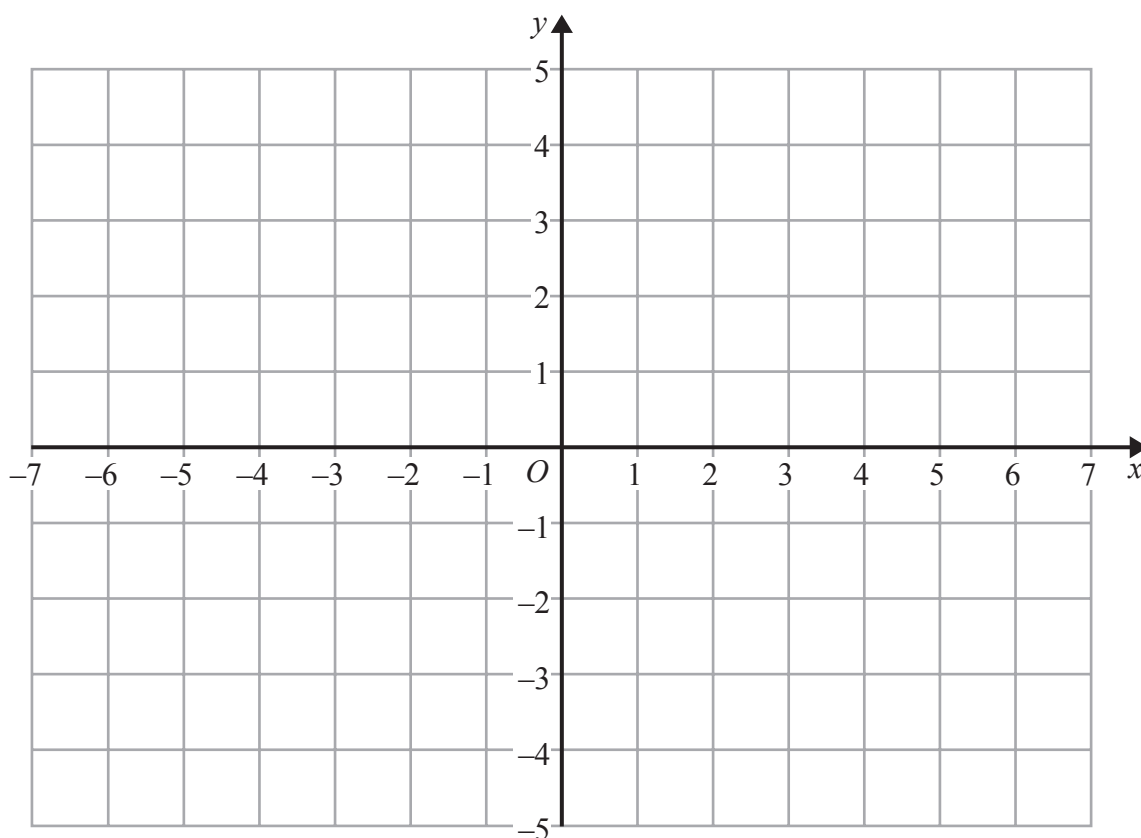(b) Sketch the graph of p against n for $n > 0$

(1)

(Total for Question 17 is 4 marks)

Turn over ▶

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

On the grid below, draw the graph of $y = \dfrac{1}{2} g(x)$

(Total for Question 18 is 2 marks)

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19 Solve algebraically the simultaneous equations

$$4x^2 - y^2 = 36$$
$$x + y = -3$$

....

(Total for Question 19 is 5 marks)

TOTAL FOR PAPER IS 90 MARKS

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