**Pearson
Edexcel Award**

Centre Number

Candidate Number

Monday 11 January 2021

Morning (Time: 2 hours)

Paper Reference **AAL30/01**

Algebra

Level 3
Calculator NOT allowed

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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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) Expand and simplify $(3x - 1)(2x + 3)$

....

(2)

(b) Simplify $\left(\dfrac{1}{7x}\right)^{-2}$

....

(2)

(c) Write $(4y^2)^{\frac{3}{2}}$ in the form ay^n where a and n are integers.

....

(2)

(Total for Question 1 is 6 marks)

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

$$y > 1 \qquad 3x + 2y < 9 \qquad y < \frac{1}{2}x + 3$$

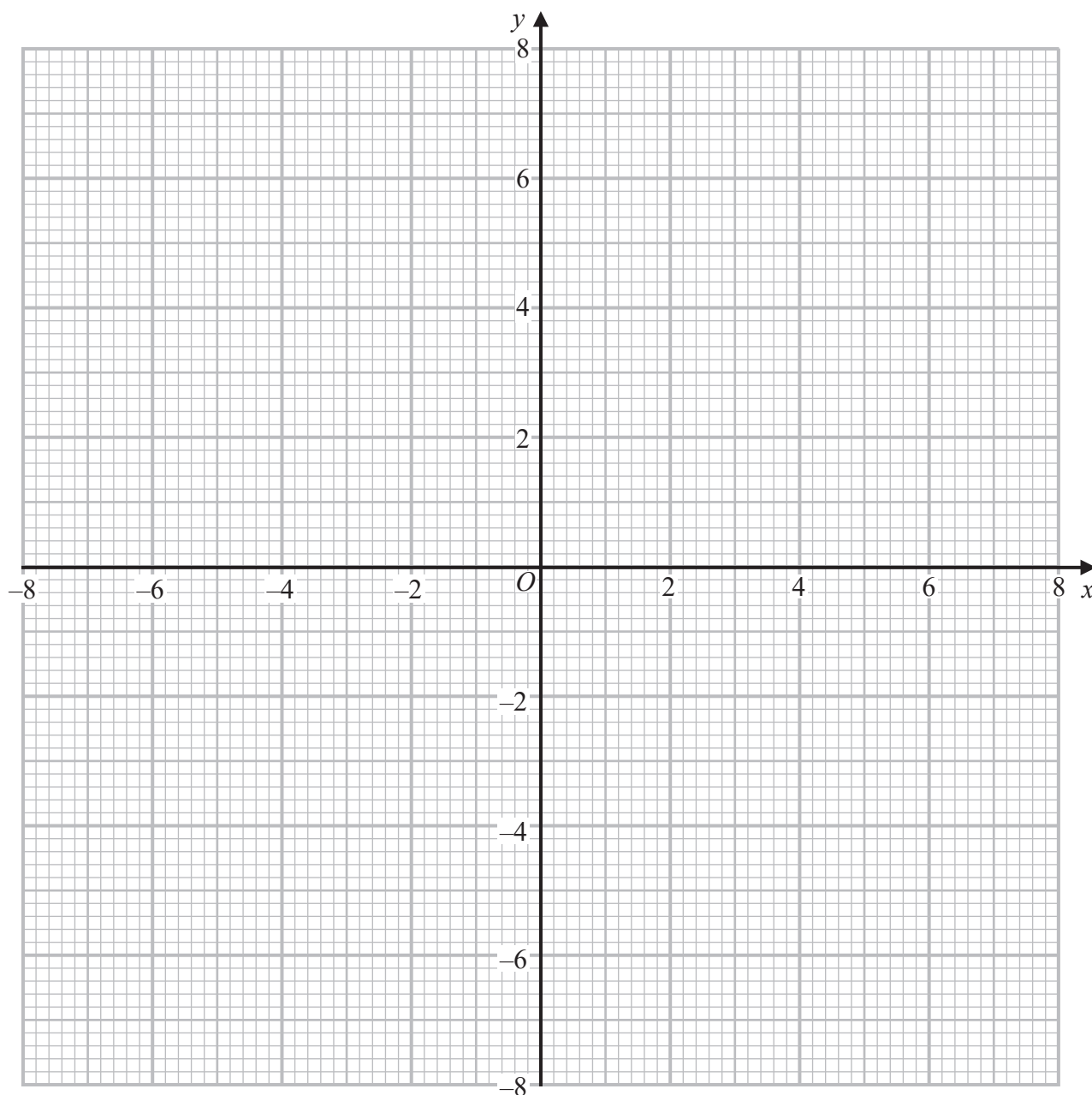Label the region **R**
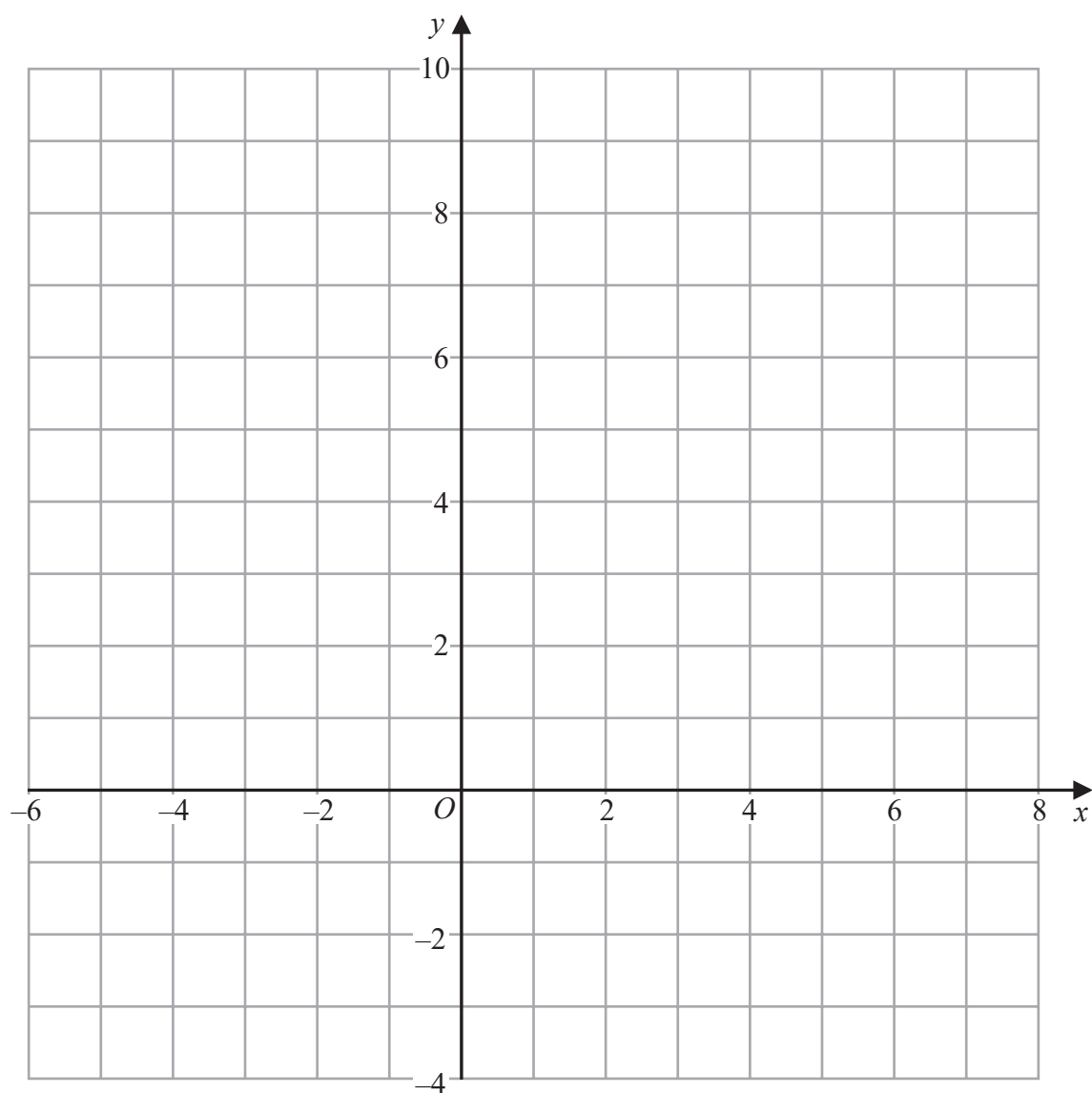
(Total for Question 2 is 5 marks)

Turn over ▶

3 (a) On the grid,

(i) construct the graph of $x^2 + y^2 = 25$

(ii) draw the graph of $y = x^2 - 4$ for values of x from -3 to 3

(b) Use your graphs to find estimates for the solutions of the simultaneous equations

$$y = x^2 - 4$$
$$x^2 + y^2 = 25$$

....

(2)

(Total for Question 3 is 6 marks)

4 (a) Factorise $y^2 - x^2$

....
(1)

(b) Factorise $6xy - 8y + 9x - 12$

....
(2)

(Total for Question 4 is 3 marks)

5 Write $\dfrac{x+2}{x-3} + \dfrac{x-2}{x+3}$ as a single fraction.

Give your answer in its simplest form.

....

(Total for Question 5 is 3 marks)

6 (a) Write the quadratic expression $2x^2 - 12x + 13$ in the form $a(x + m)^2 + n$
where a, m and n are integers.

....

(3)

(b) Hence solve the equation $2x^2 - 12x + 13 = 0$

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

....

(2)

(Total for Question 6 is 5 marks)

7 (a) On the grid below, draw the graph of $y = (x - 1)(x + 1)(x - 3)$ for values of x from -2 to 4
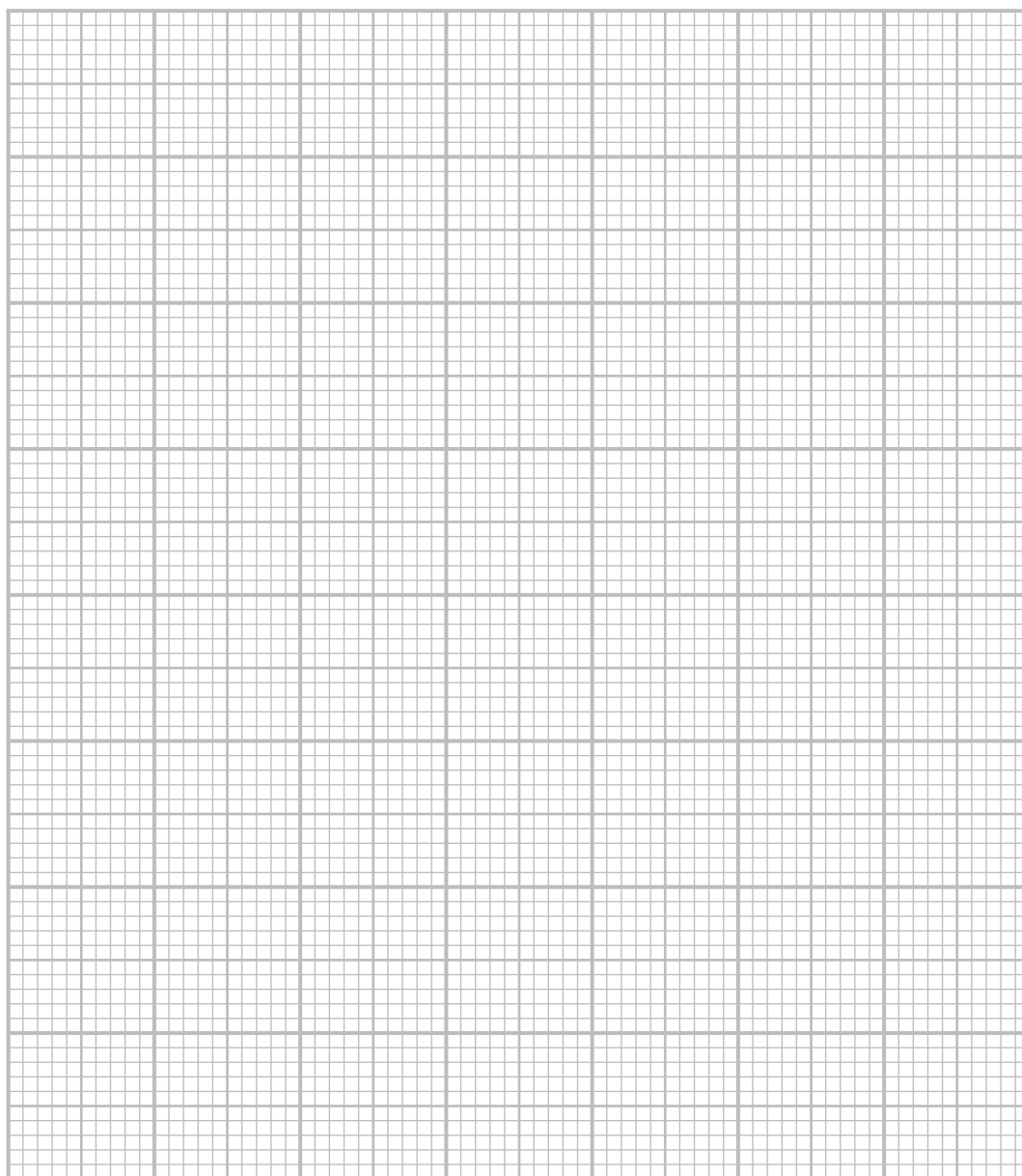
(4)

(b) Use your graph to find estimates for the solutions of $(x - 1)(x + 1) = \dfrac{2}{x - 3}$

....

(3)

(Total for Question 7 is 7 marks)

8 Here is a formula $B = \dfrac{13w}{25h^2}$

(a) Find the value of B when $w = 8$ and $h = 2$

....

(2)

(b) Make h the subject of the formula.

....

(2)

$$m - k = \dfrac{2k}{5n}$$

(c) Make k the subject of the formula.

....

(3)

(Total for Question 8 is 7 marks)

Turn over ▶

9 (a) Solve $x^2 > 9$

....

(2)

(b) (i) Use the quadratic formula to solve the equation $3x^2 - 4x - 2 = 0$

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

....

(3)

(ii) Hence solve $3x^2 - 4x - 2 < 0$

....

(1)

(Total for Question 9 is 6 marks)

10 y is inversely proportional to the cube of x.

$y = 2$ when $x = 3$

(a) Find a formula for y in terms of x.

....

(3)

(b) Calculate the value of x when $y = 9$

Write your answer in the form $b^{\frac{1}{n}}$ where n and b are integers.

....

(2)

(Total for Question 10 is 5 marks)

11 Here is an identity.

$2x^2 - 7x + 6 = (ax - b)(x - c)$ where a, b and c are integers.

Find the value of a, the value of b and the value of c.

$a = $ ....

$b = $ ....

$c = $ ....

(Total for Question 11 is 2 marks)

12 Using the axes below, sketch the graph of $y = \dfrac{1}{x} + 1$

Label clearly any asymptotes.
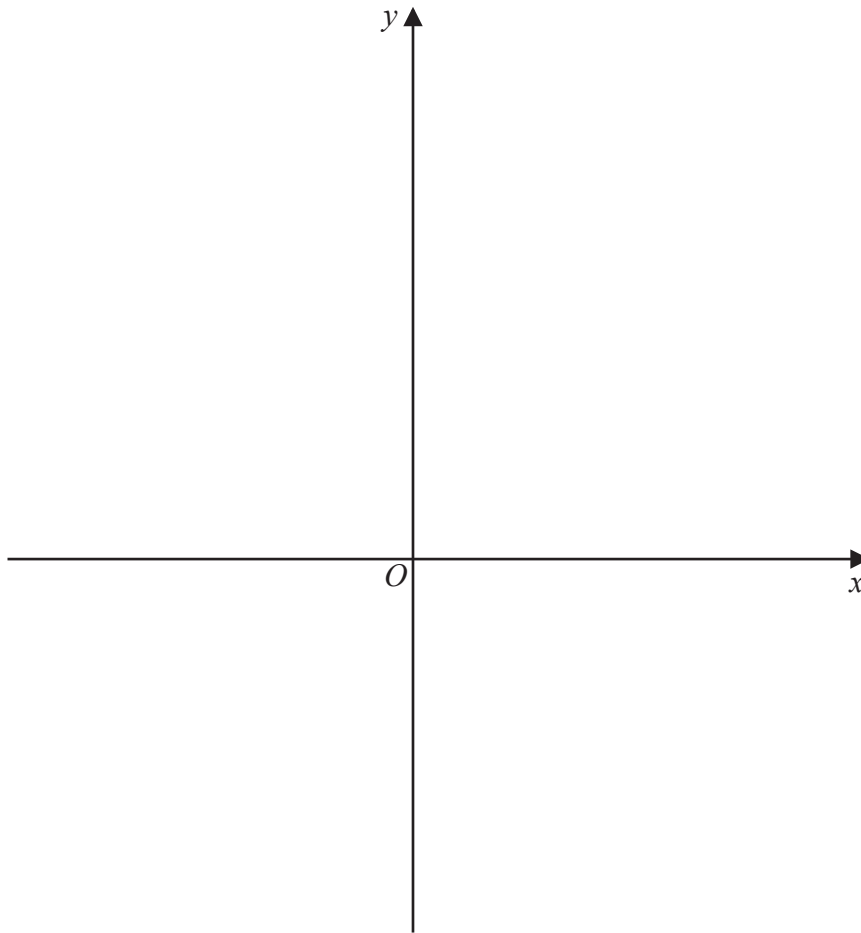
(Total for Question 12 is 3 marks)

13 Solve, algebraically, the simultaneous equations

$$2x - 2 = y$$
$$2x^2 - 6 = 3y$$

....

(Total for Question 13 is 4 marks)

14 The quadratic equation $ax^2 + 6x + 5 = 0$ has two equal roots.

(a) Find the value of a.

....
(2)

Here is another quadratic equation.

$$3x^2 - 5x - 8 = 0$$

(b) For this quadratic equation, write down the sum of its roots and the product of its roots.

sum of roots ....

product of roots ....
(2)

(Total for Question 14 is 4 marks)

15 The point A has coordinates $(2, 7)$ and the point B has coordinates $(-2, -5)$

The straight line **L** passes through point A and point B.

The point D has coordinates $(3, 5)$

(a) Find an equation of the straight line which passes through D and is parallel to **L**
Give your answer in the form $y = mx + c$

....

(3)

The line **M** is perpendicular to the line **L**

(b) Write down the gradient of **M**

....

(1)

(Total for Question 15 is 4 marks)

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16 The first term of an arithmetic series is 6
The common difference of the series is 12

(a) Work out the 10th term of the series.

....
(2)

The nth term of a different arithmetic series is $9n - 11$
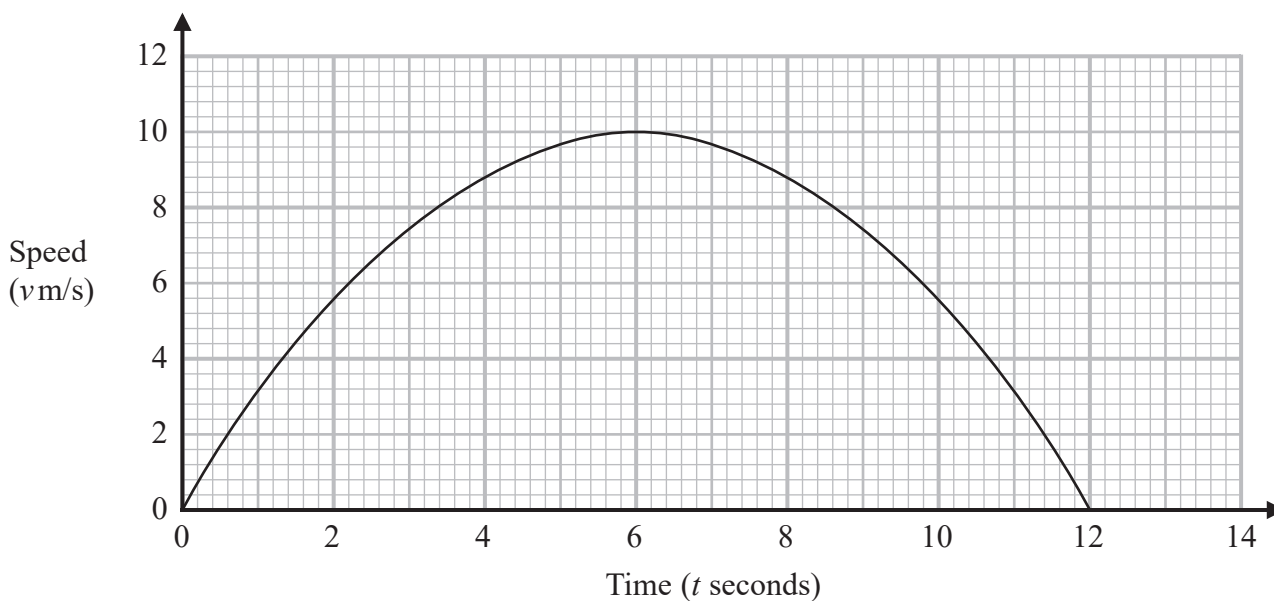
(b) Work out the sum of the first 20 terms of this series.

....
(3)

(Total for Question 16 is 5 marks)

17 A ball moves so that its speed is v m/s at time t seconds after starting from rest.

The speed-time graph for the ball is drawn on the grid.

The ball is moving at its maximum speed at time T seconds.

(a) (i) Write down the value of T.

$T = $ ....

(1)

(ii) Write down the gradient of the tangent to the curve at the time when the ball is moving at its maximum speed.

....

(1)

(b) Work out an estimate of the acceleration of the ball when $t = 3$

....m/s^2

(2)

Here is the speed-time graph for the ball.
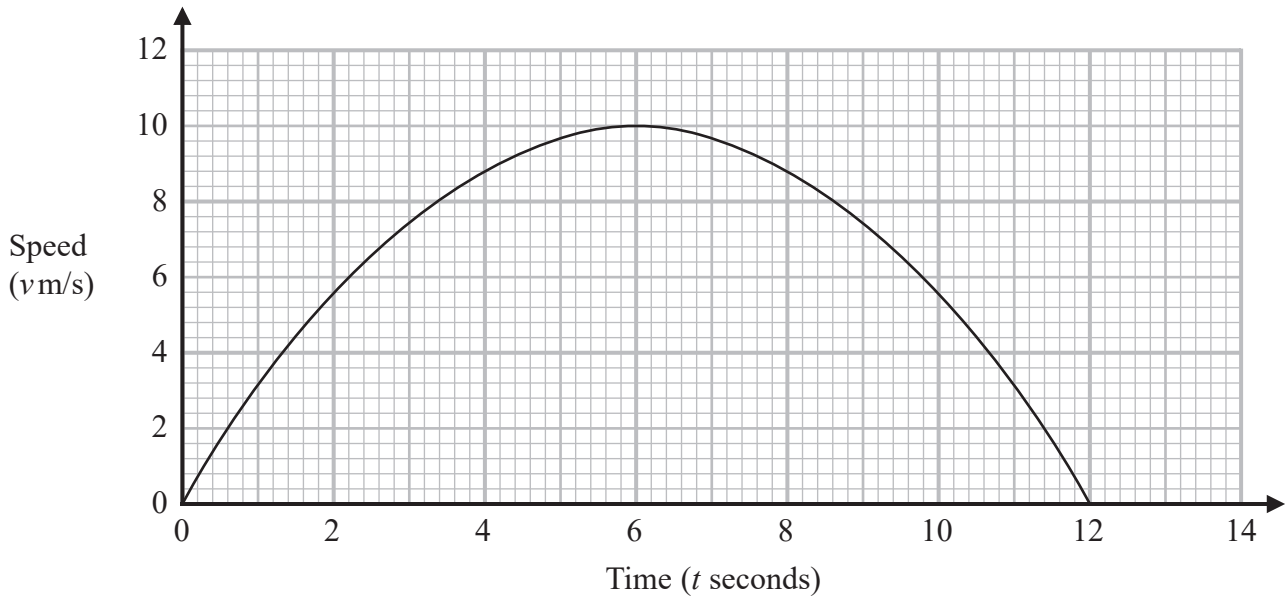
(c) Use the trapezium rule to find an estimate of the area of the region under the curve and between $t = 0$, $t = 10$ and the time axis.
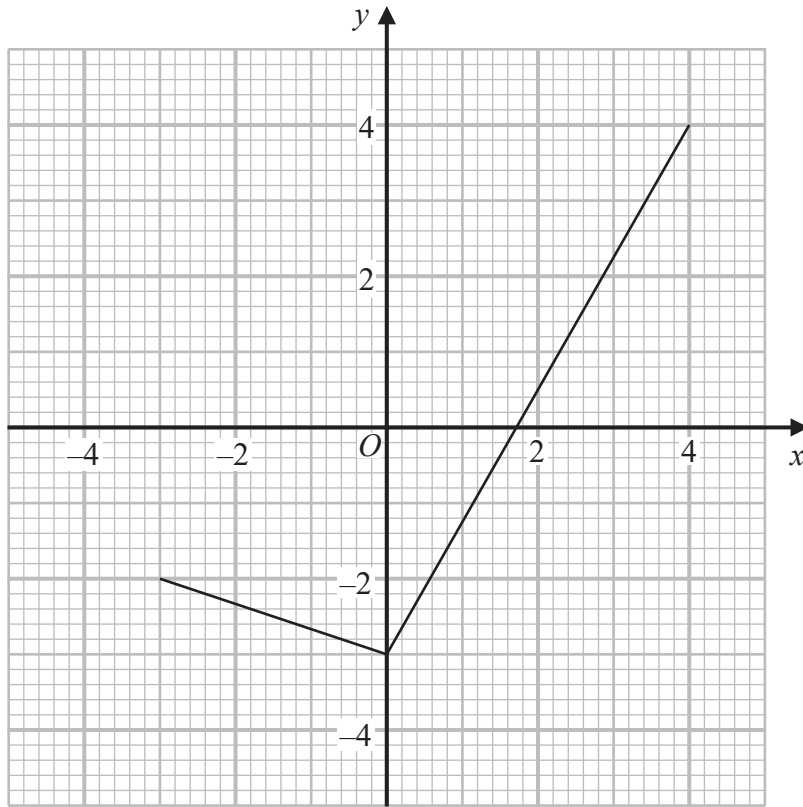Use 5 strips of equal width.

....

(3)

(d) What does this area represent?

....

(1)

(Total for Question 17 is 8 marks)

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

(a) On the grid below, draw the graph of $y = -f(x)$
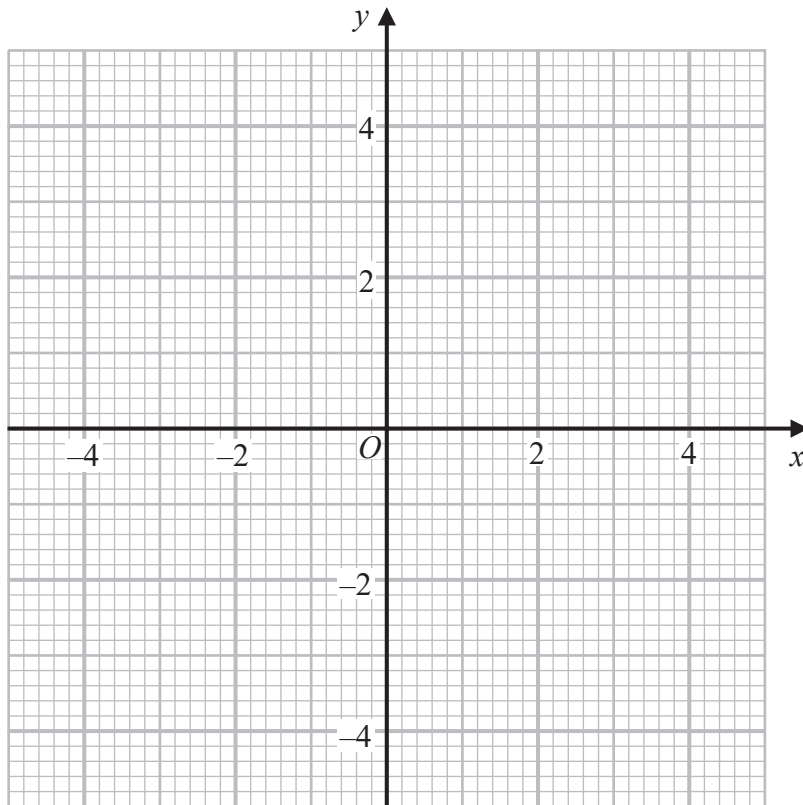
(2)

Here is the graph of $y = f(x)$
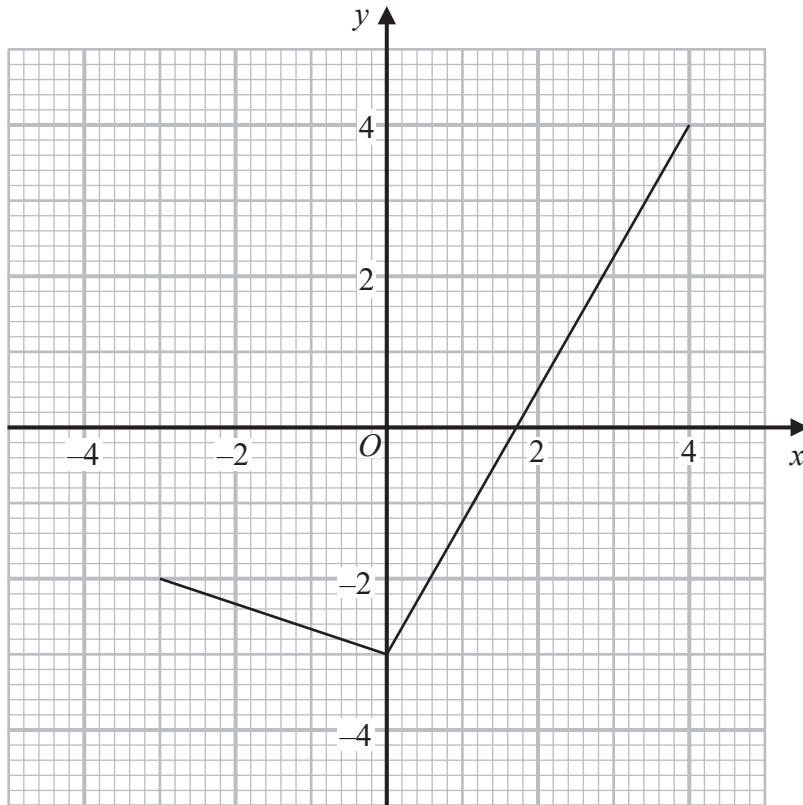
(b) On the grid below, draw the graph of $y = f(x + 2)$

(2)
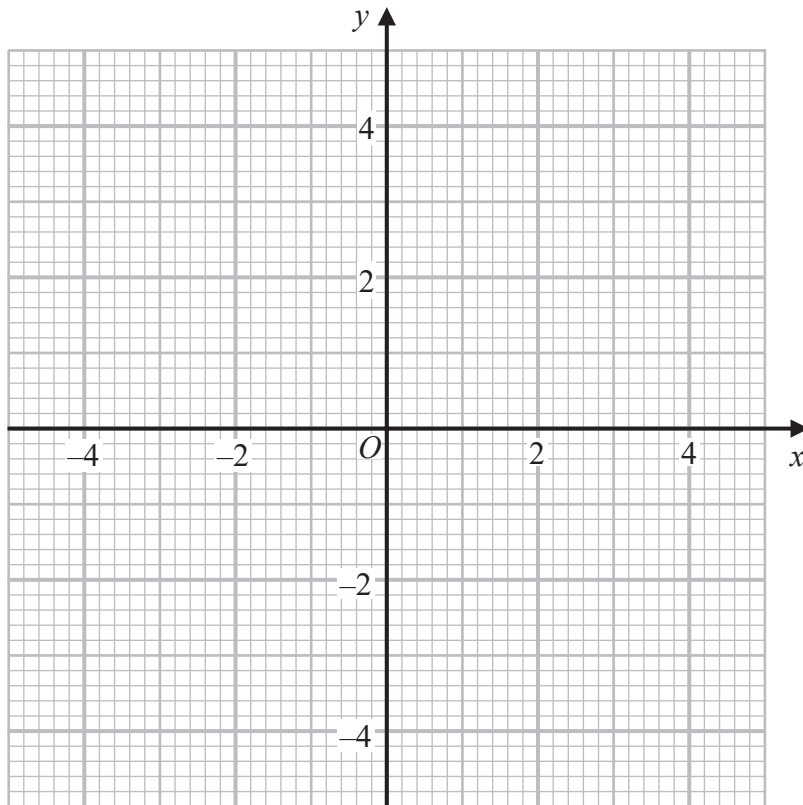
(Total for Question 18 is 4 marks)

Turn over ▶

19 Rationalise the denominator of $\dfrac{7}{3 + 2\sqrt{5}}$

Give your answer in its simplest form.

....

(Total for Question 19 is 3 marks)

TOTAL FOR PAPER IS 90 MARKS

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