Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Award

Thursday 11 January 2024

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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

P72930A

P 7 2 9 3 0 A 0 1 2 4

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

.....

(2)

(b) Expand and simplify $(2y + 5)^2$

.....

(2)

(c) Simplify $(36t^8)^{\frac{1}{2}}$

.....

(2)

(d) Simplify $r^{-3} \times r^{-\frac{1}{4}}$

.....

(1)

(Total for Question 1 is 7 marks)

2 Make m the subject of $d = 6 - \frac{3}{m^2}$

.....

(Total for Question 2 is 3 marks)

3 Use the quadratic formula to solve the equation $5x^2 = 3x + 2$

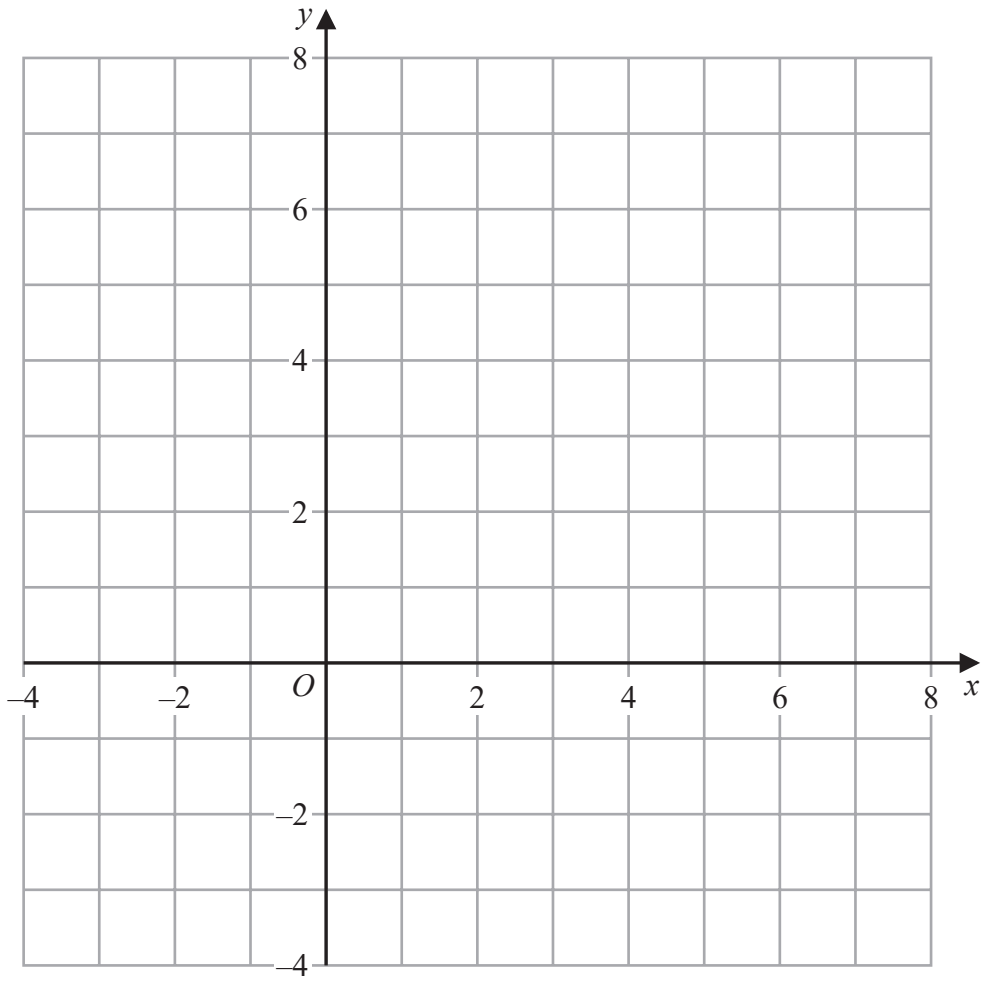
.....

(Total for Question 3 is 2 marks)

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

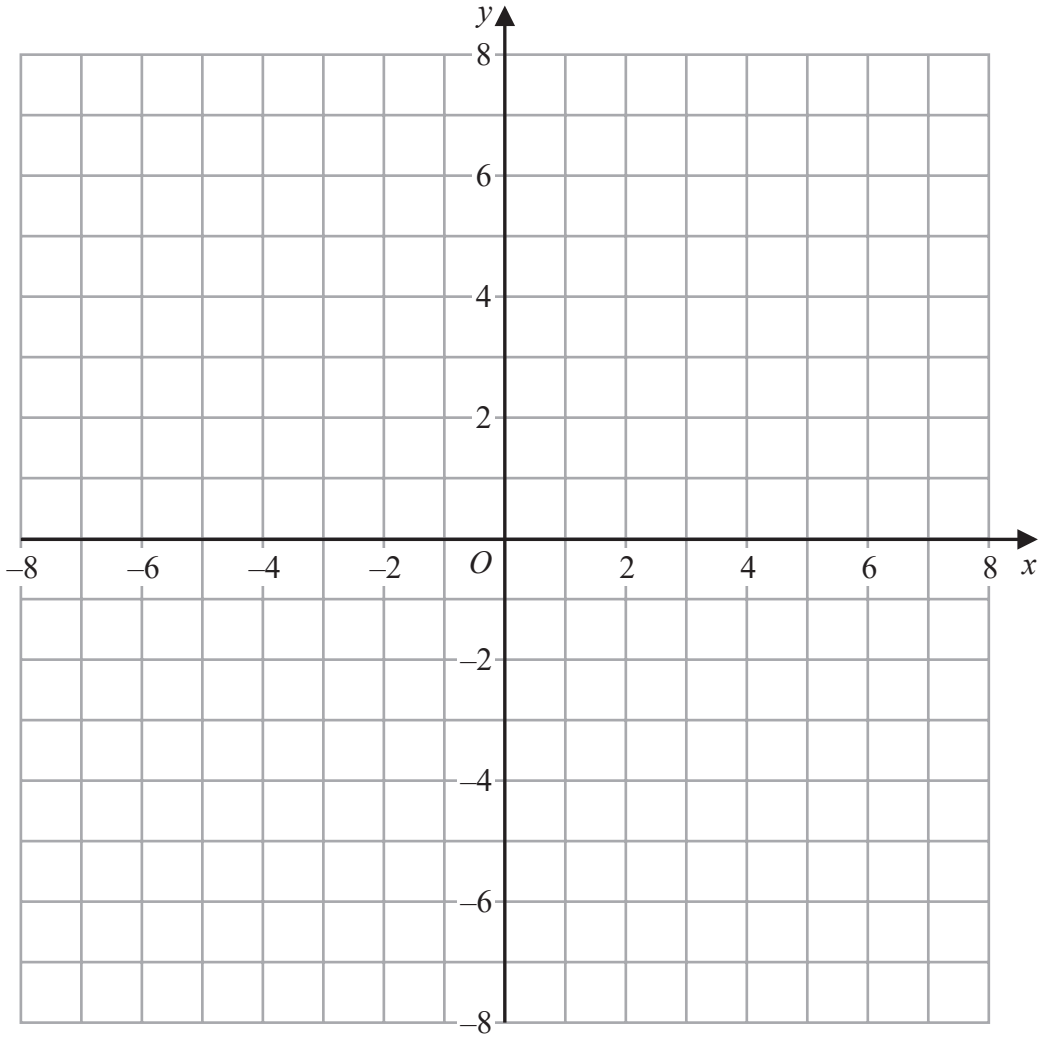
$x > -1$ $y > 2$ $3x + 5y > 15$ $y - x < 6$

Label the region **R**



(Total for Question 4 is 5 marks)

5 (a) On the grid, construct the graph of $x^2 + y^2 = 16$



(2)

The point P with coordinates $(p, 0)$ lies on the graph of $x^2 + y^2 = 16$

Given that $p > 0$,

(b) write down the equation of the tangent to the graph at the point P.

.....

(1)

(Total for Question 5 is 3 marks)

6 (a) Solve $13 - 7x > 3x - 47$

.....

(2)

(b) (i) Factorise $y^2 + 2y - 8$

.....

(1)

(ii) Hence, or otherwise, solve $y^2 + 2y - 8 < 0$

.....

(2)

(Total for Question 6 is 5 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

7 (a) Find the gradient of a line parallel to the line $4y = 3x$

.....

(1)

(b) Find an equation of the straight line which passes through the origin and is perpendicular to the straight line with equation $2x = 5y + 3$

.....

(2)

(Total for Question 7 is 3 marks)

8 Here is a quadratic equation.

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

Use the discriminant to determine whether the equation has

2 real and different roots
or 2 real and equal roots
or no real roots.

.....

(Total for Question 8 is 2 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

9 (a) Factorise $10xy^3 + 15x^2y^2$

.....

(2)

(b) Factorise $p^2q^2 - q^2$

.....

(2)

(Total for Question 9 is 4 marks)

10 $x^2 + 8x + 11$ can be written in the form $(x + a)^2 + b$

(a) Find the value of a and the value of b.

$a =$ .....

$b =$ .....

(2)

The graph of $y = x^2 + 8x + 11$ has a turning point at the point T.

(b) Write down the coordinates of T.

.....

(1)

(Total for Question 10 is 3 marks)

11 The first term of an arithmetic series is 6
The common difference of the series is 5

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

.....

(2)

The pth term of the series is 121

(b) Work out the value of p.

.....

(1)

(c) Find the sum of the first 101 terms of this series.

.....

(2)

(Total for Question 11 is 5 marks)

12 The time taken, t hours, to complete a journey of a given distance is inversely proportional to the average speed, v km/h, for that journey.

When $t = 5$, $v = 60$

(a) Find a formula for t in terms of v.

.....

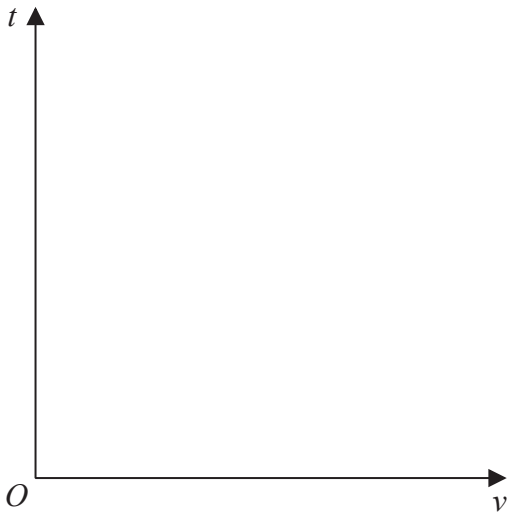
(3)

(b) Find the value of v when $t = 6$

.....

(2)

(c) Sketch the graph of t against v.



(1)

(Total for Question 12 is 6 marks)

13 Here is a quadratic equation.

$$3x^2 - 5x + 4 = 0$$

(i) Write down the product of the roots of this equation.

.....

(1)

(ii) Write down the sum of the roots of this equation.

.....

(1)

(Total for Question 13 is 2 marks)

14 $P = \dfrac{a(b + c)}{3c}$

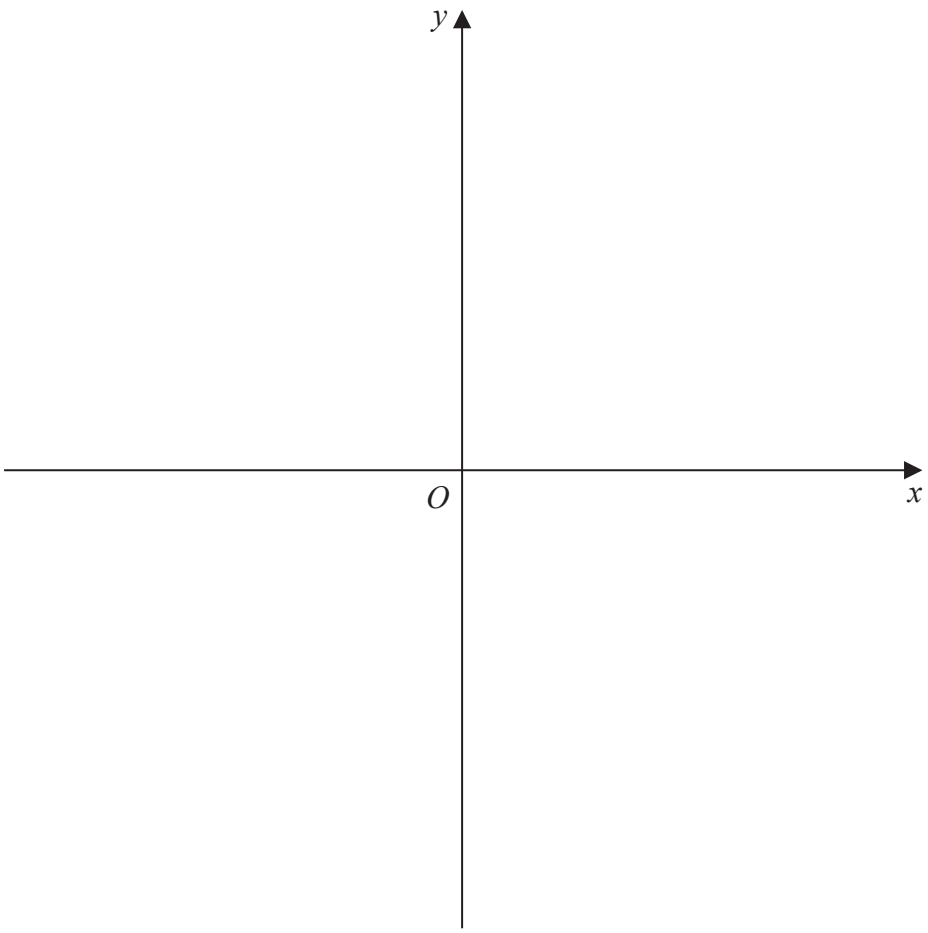
Work out the value of c when $P = 27$, $a = 9$, $b = 20$

.....

(Total for Question 14 is 3 marks)

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

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



(Total for Question 15 is 4 marks)

16 Solve the simultaneous equations

$$y = 5x^2 - 22x - 5$$

$$y = 2x$$

.....

(Total for Question 16 is 4 marks)

17 (a) Expand and simplify $\sqrt{5}\left(3-\sqrt{5}\right)^2$

.....

(3)

(b) Rationalise the denominator of $\dfrac{2+\sqrt{7}}{3-\sqrt{7}}$

Give your answer in the form $\dfrac{p+q\sqrt{7}}{2}$ where p and q are integers.

.....

(3)

(Total for Question 17 is 6 marks)

18 The straight line **L** passes through the points P and Q.

P is the point (–3, 11)
Q is the point (2, –4)

Find an equation for **L**
Give your answer in the form $y = mx + c$ where m and c are integers.

.....

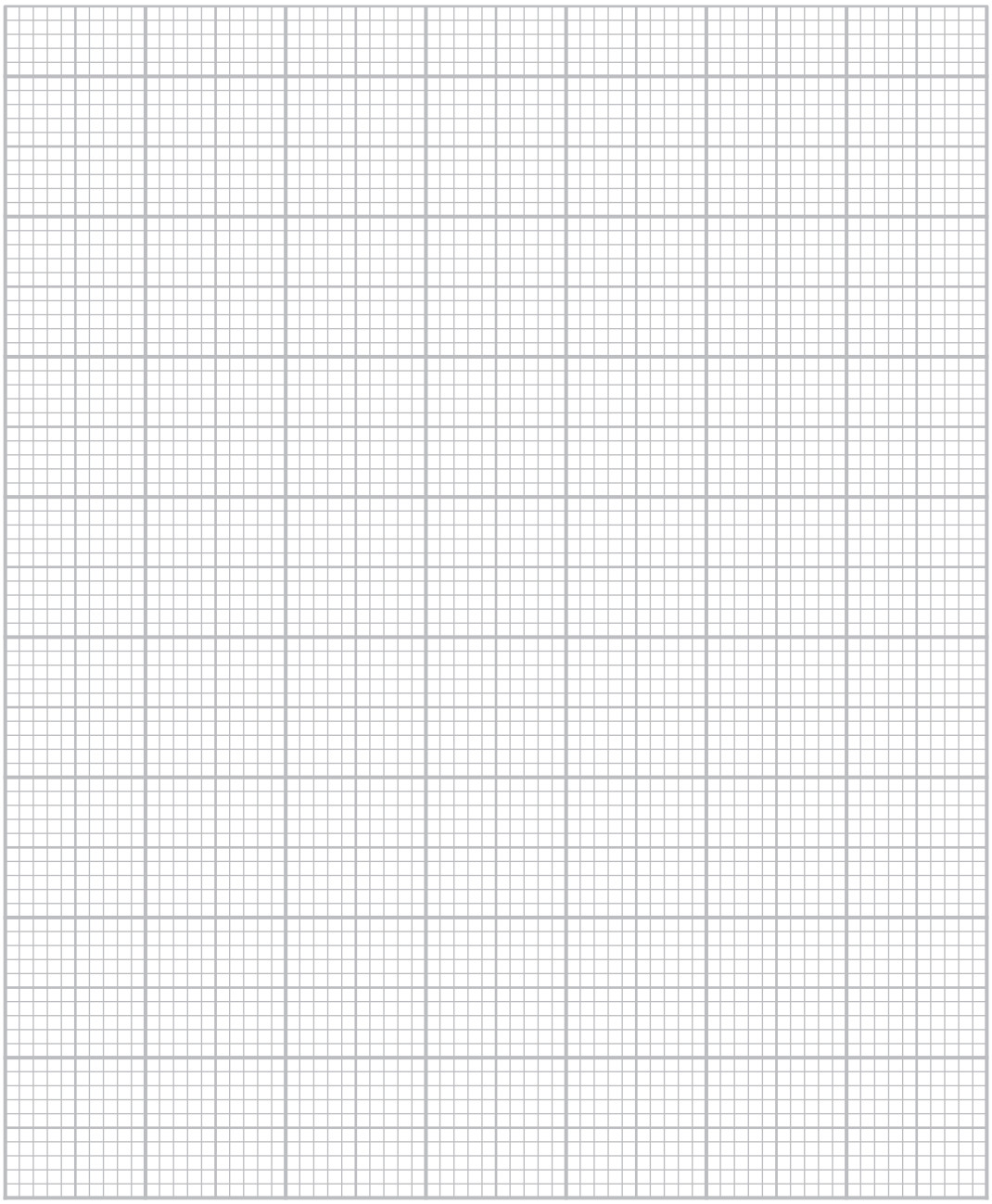
(Total for Question 18 is 3 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

19 The table shows the values of $y = 2^{1-x}$ for integer values of x from –2 to 4

x	–2	–1	0	1	2	3	4
y	8	4	2	1	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$

(a) On the grid, draw the graph of $y = 2^{1-x}$ for values of x from –2 to 4



(2)

(b) Use your graph to find an estimate, to one decimal place, for the solution of $2^{-x} = 3$

.....

(2)

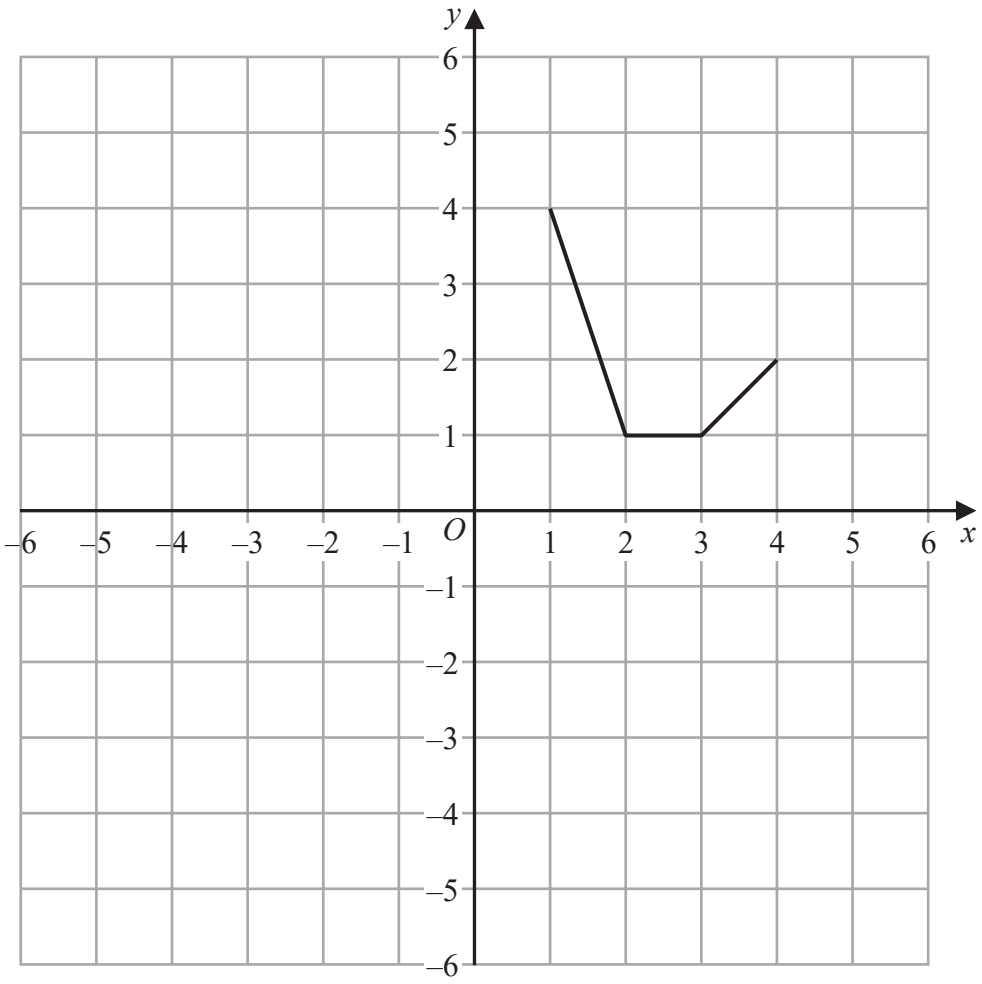
(c) Use the trapezium rule to find an estimate for the area of the region under the curve and between $x = -1$, $x = 2$ and the x-axis.
Use 3 strips of equal width.

.....

(2)

(Total for Question 19 is 6 marks)

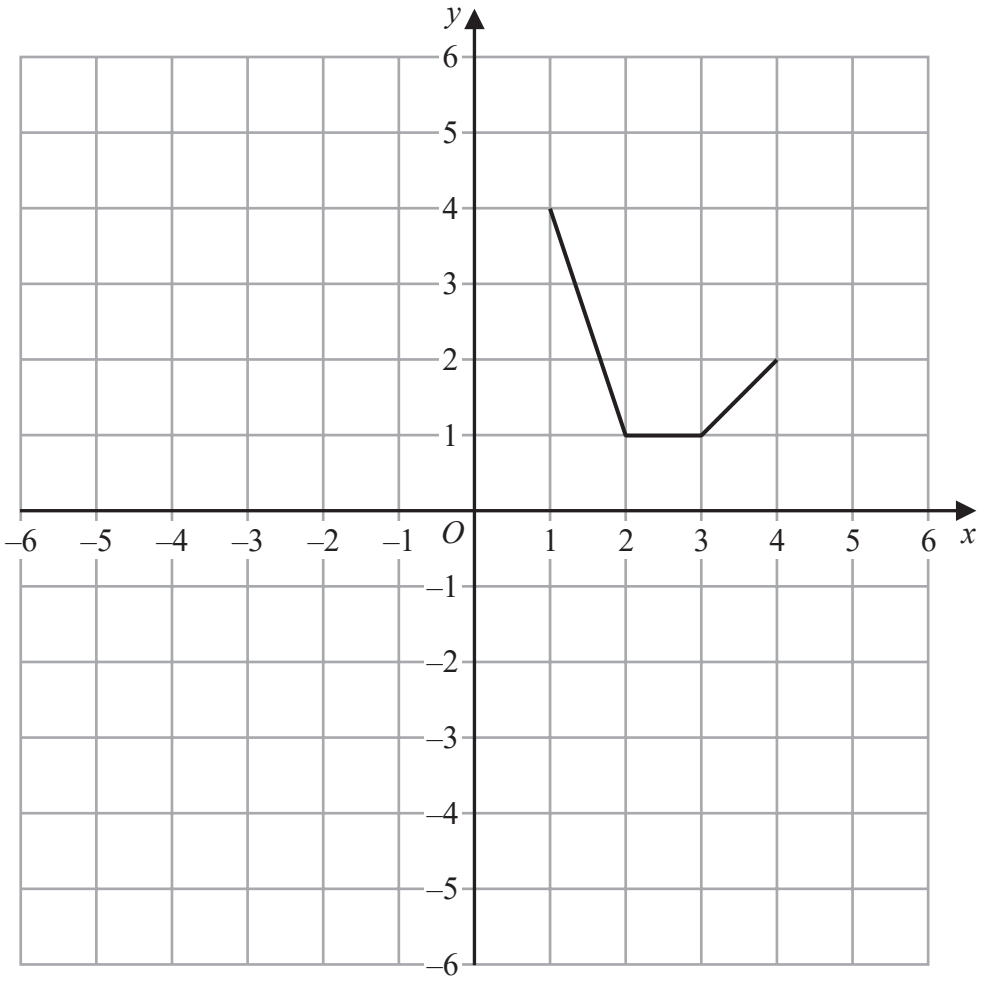
20 Here is the graph of $y = f(x)$



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

(2)

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

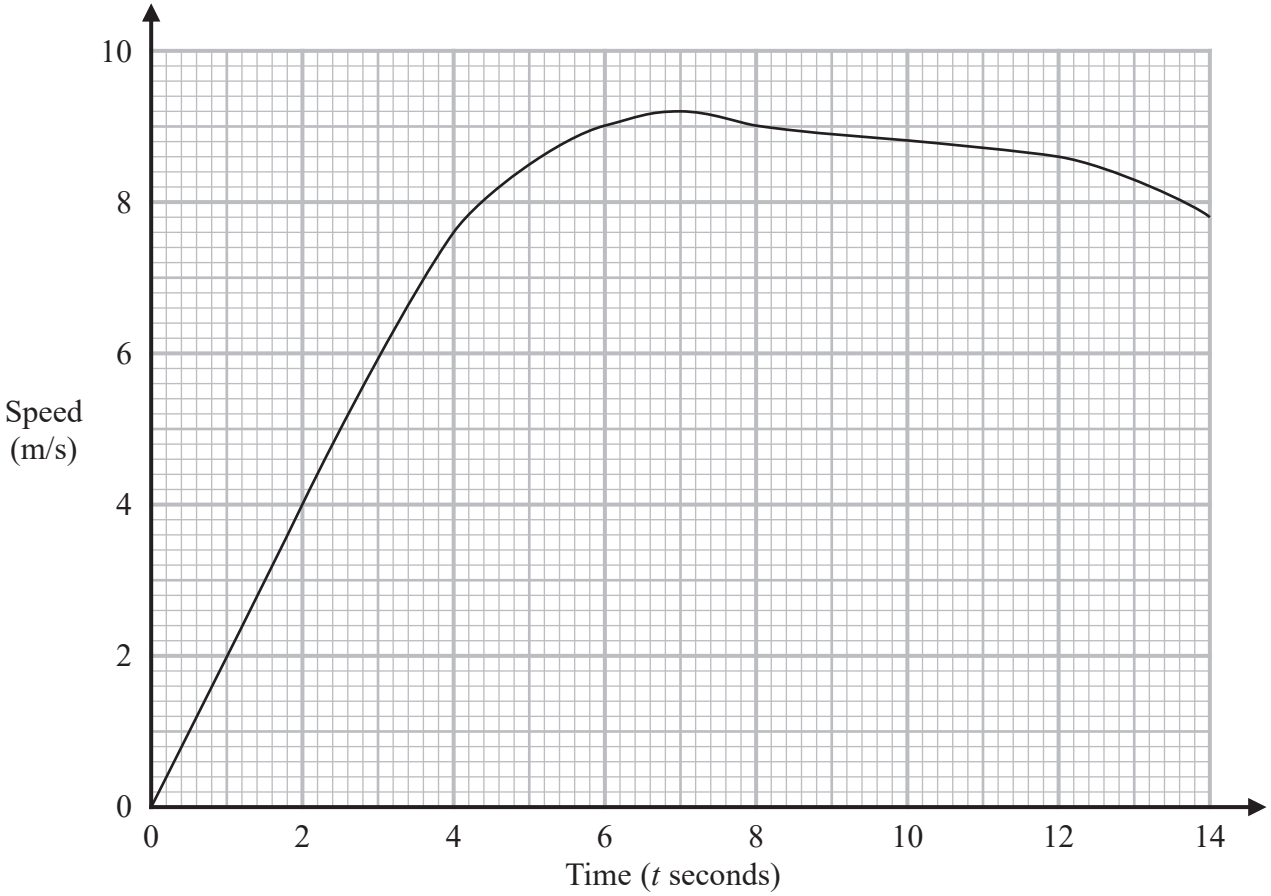


(b) On the grid above, draw the graph of $y = f(x + 2)$

(2)

(Total for Question 20 is 4 marks)

21 Here is a speed-time graph for a sprinter running a race.



(a) Find the speed of the sprinter at time $t = 4$

..... m/s

(1)

(b) For how many seconds is the sprinter accelerating?

..... seconds

(1)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(c) Work out an estimate for the distance travelled by the sprinter between $t = 6$ and $t = 8$

..... metres

(2)

(Total for Question 21 is 4 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

22 (a) Simplify $\dfrac{x^2 - 3x}{x^2 - 5x + 6}$

.....

(2)

(b) Solve $\dfrac{1}{x+1} + \dfrac{2}{x+2} = 2$

.....

(4)

(Total for Question 22 is 6 marks)

TOTAL FOR PAPER IS 90 MARKS

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

BLANK PAGE