Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Time **1 hour 30 minutes**

Paper reference **1MA1/3H**

Mathematics

PAPER 3 (Calculator)
Higher Tier

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

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*.
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.

Information

- 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.*

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.
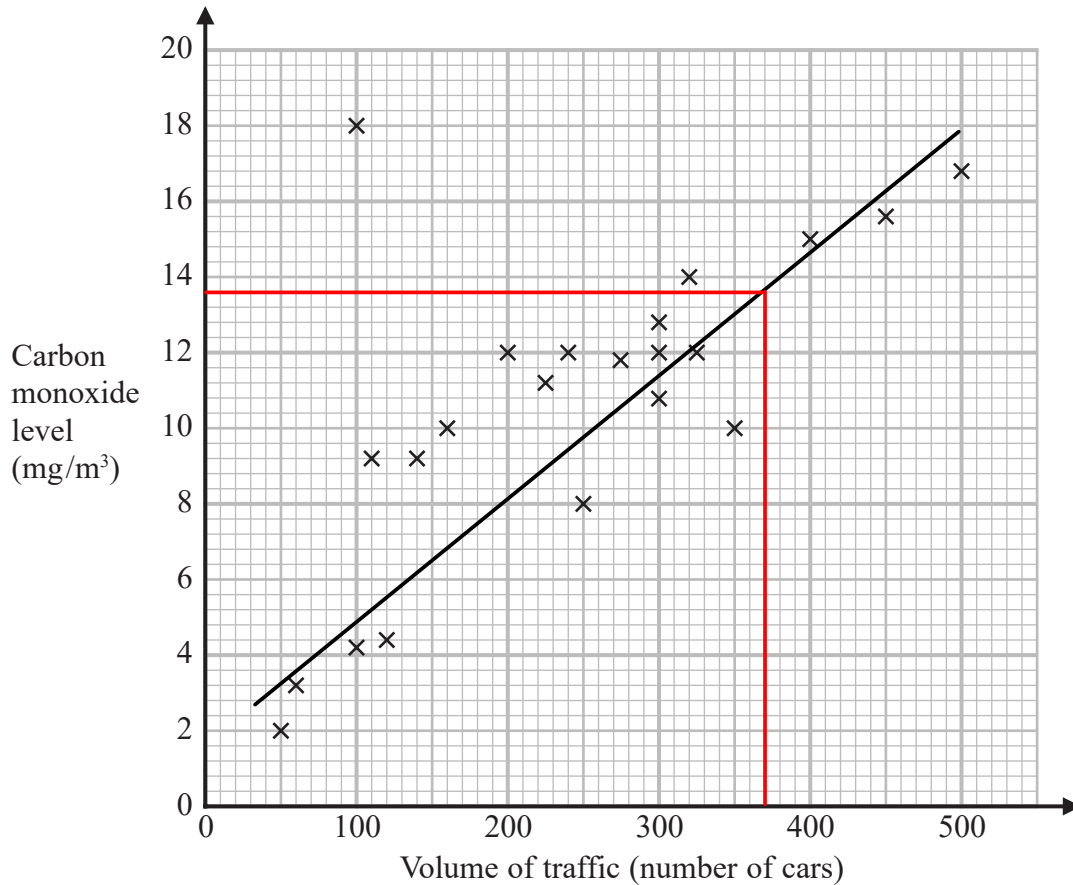
Turn over ▶

Pearson

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 The scatter graph shows information about the volume of traffic and the carbon monoxide level at a point on a road each day for 22 days.

One point is an outlier.

(a) Write down the coordinates of this point.

(.....100..... , ...18.....)

(1)

For another day, 370 cars pass the point on the road.

(b) Estimate the carbon monoxide level for this day.

.................13.8................. mg/m^3

(2)

12.8 to 14.8

Alfie says,

"Because there is an outlier, there is no correlation."

(c) Is Alfie correct?
You must give a reason for your answer.

No.   There is a positive correlation.

(1)

(Total for Question 1 is 4 marks)

2 Natalie makes potato cakes in a restaurant.

She mixes potato, cheese and onion so that

weight of potato : weight of cheese : weight of onion = 9 : 2 : 1

Natalie needs to make 6000 g of potato cakes.

12 parts

Cheese costs £2.25 for 175 g.

Work out the cost of the cheese needed to make 6000 g of potato cakes.

$$\frac{6000}{12} = 500g \quad (\text{each part})$$

$$2 \times 500 = 1000g \quad (\text{cheese})$$

$$\frac{1000}{175} = 5.714...$$

$$5.714 \times 2.25 = £12.86$$

OR $\quad 6 \times 2.25 = £13.50$

£ *12.86*

(Total for Question 2 is 4 marks)

3 (a) Write 4.5×10^5 as an ordinary number.

450 000

(1)

(b) Write 0.007 in standard form.

7×10^{-3}

(1)

(c) Work out $4.2 \times 10^3 + 5.3 \times 10^2$
Give your answer in standard form.

4730

4.73×10^3

(2)

(Total for Question 3 is 4 marks)

4 A water tank is empty.
Anil needs to fill the tank with 2400 litres of water.

Company **A** supplies water at a rate of 8 litres in 1 minute 40 seconds.
Company **B** supplies water at a rate of 2.2 gallons per minute.

1 gallon = 4.54 litres

Company **A** would take more time to fill the tank than Company **B** would take to fill
the tank.

How much more time?
Give your answer in minutes correct to the nearest minute.

A
40 seconds = $\frac{2}{3}$ min

$1 + \frac{2}{3} = \frac{5}{3}$

$\frac{2400}{8} = 300$

$300 \times \frac{5}{3} = \underline{500 \text{ mins}}$

B
2.2 gallons

$2.2 \times 4.54 = 9.988$

9.988 litres per min

$\frac{2400}{9.988} = \underline{240.288 \text{ mins}}$

$500 - 240 = \underline{260}$

..................260.................. minutes

(Total for Question 4 is 4 marks)

5 The first four terms of a Fibonacci sequence are

$$a \qquad 2a \qquad 3a \qquad 5a \qquad 8a$$

The sum of the first five terms of this sequence is 228

Work out the value of *a*.

$$a + 2a + 3a + 5a + 8a = 228$$
$$19a = 228$$
$$a = \frac{228}{19}$$
$$= 12$$

12

(Total for Question 5 is 3 marks)

6 In a bag there are only red counters, blue counters, green counters and pink counters.
A counter is going to be taken at random from the bag.

The table shows the probabilities of taking a red counter or a blue counter.

Colour	red	blue	green	pink
Probability	0.05	0.15	0.5	0.3
			$x + 0.2$	x

The probability of taking a green counter is 0.2 more than the probability of taking a pink counter.

(a) Complete the table.

$$0.05 + 0.15 + x + 0.2 + x = 1$$
$$2x + 0.4 = 1$$
$$2x = 0.6$$
$$x = 0.3$$

(2)

There are 18 blue counters in the bag.

(b) Work out the total number of counters in the bag.

$$0.15 \text{ of total} = 18$$
$$0.15x = 18$$
$$x = \frac{18}{0.15}$$

120

(2)

(Total for Question 6 is 4 marks)

7 The diagram shows a sector *OPQR* of a circle, centre *O* and radius 8 cm.
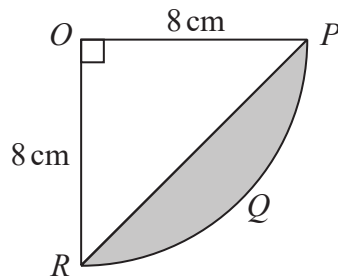
OPR is a triangle.

Work out the area of the shaded segment *PQR*.
Give your answer correct to 3 significant figures.

$$\text{Area of } \tfrac{1}{4} \text{ circle} = \frac{\pi(8)^2}{4} = 16\pi \text{ cm}^2$$

$$\text{Area of triangle} = \tfrac{1}{2}(8)(8) = 32 \text{ cm}^2$$

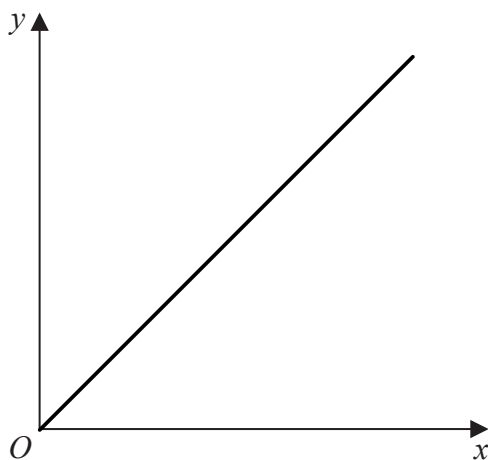$$16\pi - 32 = 18.3 \text{ cm}^2$$

..........18.3.......... cm²

(Total for Question 7 is 4 marks)

8 (a) Using the axes below, sketch a graph to represent the statement
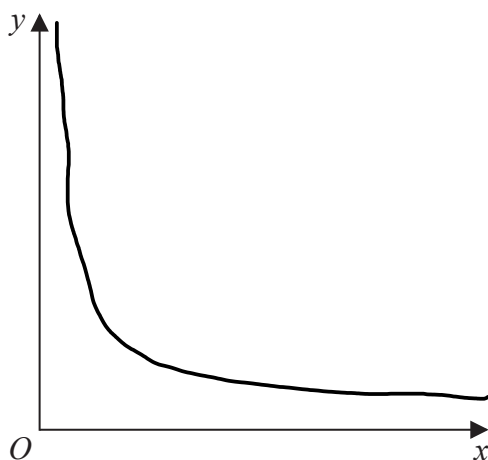
y is directly proportional to x

(1)

(b) Using the axes below, sketch a graph to represent the statement

y is inversely proportional to x

(1)

(Total for Question 8 is 2 marks)

9 On Monday, 12 people took 5 hours to clean a number of cars.
On Tuesday, 15 people cleaned the same number of cars.

Assuming that all the people worked at the same rate,

(a) work out how many hours the 15 people took to clean the cars.

$$12 \times 5 = 60 \quad (\text{hours needed})$$

$$\frac{60}{15} = 4$$

................4................ hours

(2)

The assumption is wrong.

(b) How might this affect the time taken for the 15 people to clean the cars?
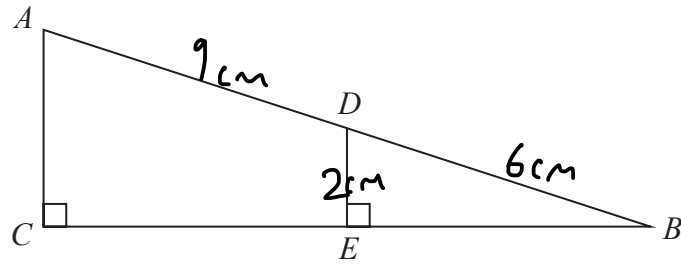
If the work at a faster rate it will take less than 4 hours. (And if they work at a slower rate it will take more than 4 hours)

(1)
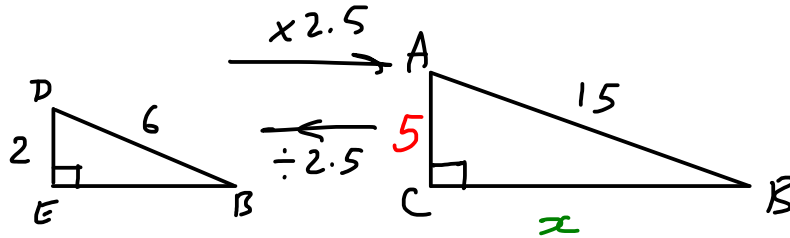
(Total for Question 9 is 3 marks)

P 6 4 6 3 4 A 0 1 1 2 4

10 The diagram shows two right-angled triangles *ACB* and *DEB*.

AD = 9 cm
DE = 2 cm
DB = 6 cm

Calculate the length of *CB*.
Give your answer correct to 2 decimal places.

$$\frac{15}{6} = 2.5$$

$$2 \times 2.5 = 5$$

$$x^2 + 5^2 = 15^2$$
$$x^2 = 15^2 - 5^2$$
$$x = \sqrt{15^2 - 5^2}$$

......14.14...... cm

(Total for Question 10 is 4 marks)

11 Freya writes down the value of x, correct to 1 decimal place.

She writes $x = 6.4$

Complete the error interval for x.

6.3   6.4   6.5

6.35   6.45
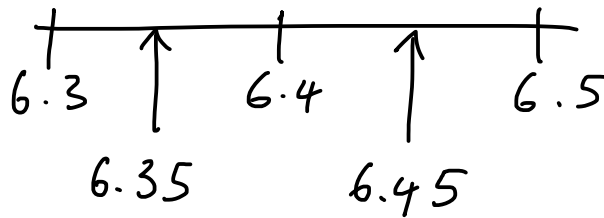
$\underline{\quad 6.35 \quad} \leqslant x < \underline{\quad 6.45 \quad}$

(Total for Question 11 is 2 marks)

12 $(ax^6)^{\frac{1}{n}} = 7x^3$

Work out the value of a and the value of n.

$a^{\frac{1}{n}} = 7$ $(x^6)^{\frac{1}{n}} = x^3$

$x^{\frac{6}{n}} = x^3$

$\underline{\underline{n = 2}}$

$a^{\frac{1}{2}} = 7$

$a = 49$

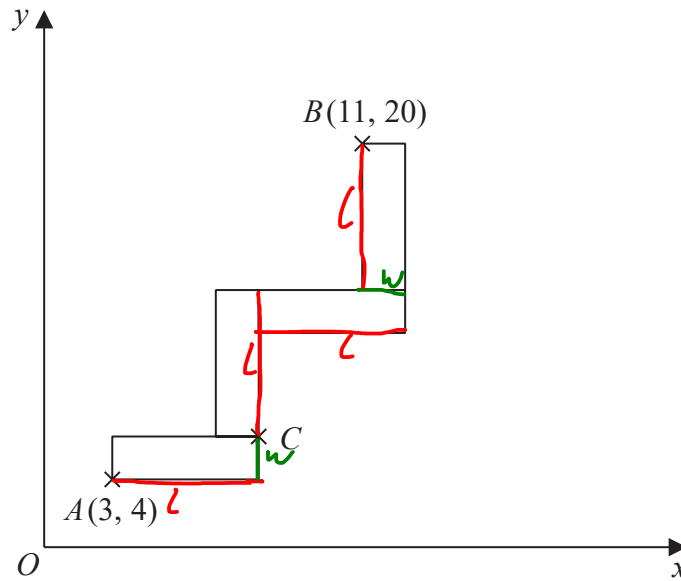$a = \underline{\quad 49 \quad}$

$n = \underline{\quad 2 \quad}$

(Total for Question 12 is 2 marks)

13 A pattern is made from four identical rectangles.
The sides of the rectangles are parallel to the axes.

$B(11, 20)$

$A(3, 4)$

O

x

y

Point *A* has coordinates (3, 4)
Point *B* has coordinates (11, 20)
Point *C* is marked on the diagram.

Work out the coordinates of *C*.
You must show all your working.

change in $y = 20 - 4$
$= 16$

$2l + w = 16$

change in $x = 11 - 3$
$= 8$

$2l - w = 8$

$2l + w = 16$
$2l - w = 8$
$2w = 8$
$w = 4$

$2l + 4 = 16$
$2l = 12$
$l = 6$

$C: (3 + 6, 4 + 4)$

$(9, 8)$

(........9........ , ...8........)

(Total for Question 13 is 5 marks)

14 Olivia and Jessica have in total half as many sweets as Fran and Gary have in total.

Fran and Gary share their sweets in the ratio $2:3$ 5 parts
Olivia and Jessica share their sweets in the ratio $9:1$ 10 parts

Fran got w sweets.
Gary got x sweets.
Olivia got y sweets.
Jessica got z sweets.

Find, in its simplest form, $w:x:y:z$

F : G   O : J

2 : 3   (5 parts)   9 : 1   (10 parts)

4 : 6   (10 parts)

F & G Have Twice As Many

8 : 12   (20 parts)

F : G : O : J

8 : 12 : 9 : 1

8 : 12 : 9 : 1

(Total for Question 14 is 4 marks)

15 The graph gives the volume of water, in litres, in a container at time t seconds after the water started to flow out of the container.
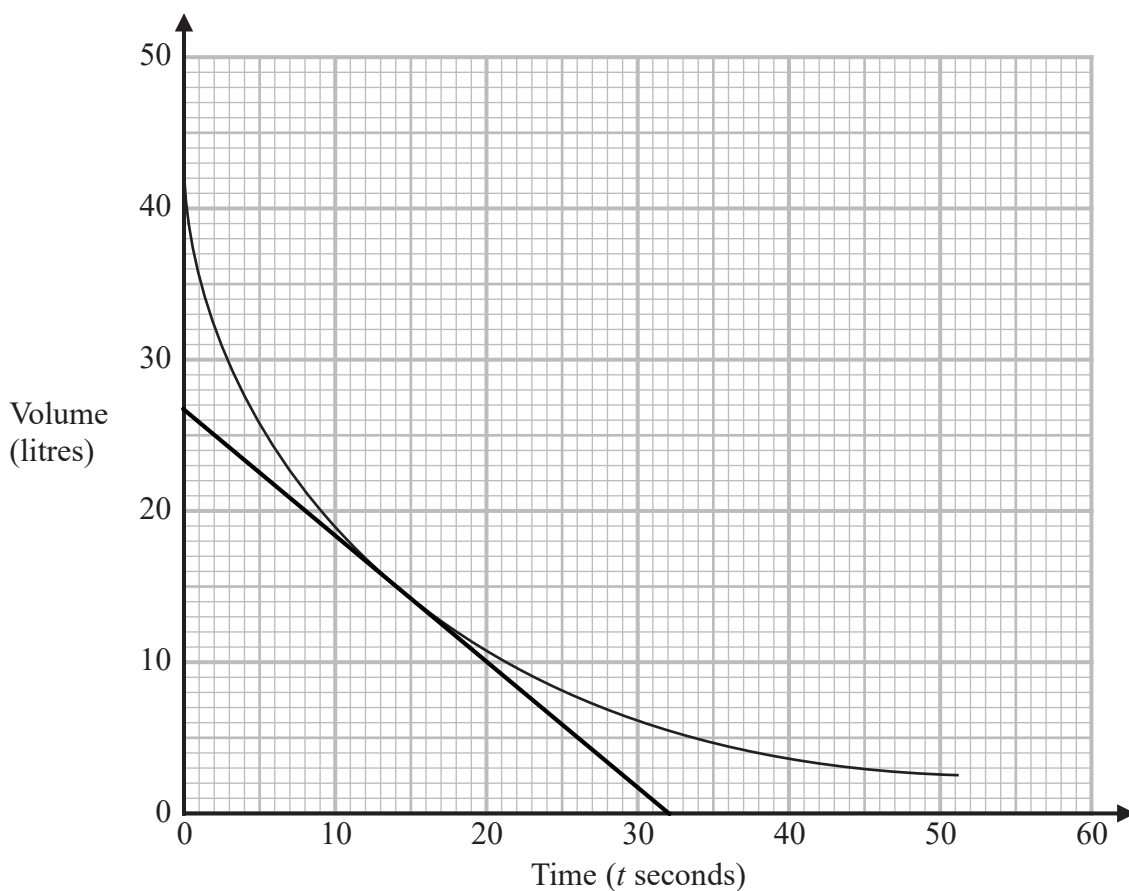
Using the graph, work out an estimate for the rate at which the water is flowing out of the container when $t = 12$
You must show your working.

$$\frac{27}{32} = 0.84 \text{ L/s}$$

0.84 .... litres per second

0.7 to 1.1

(Total for Question 15 is 3 marks)

16 The curve **C** has equation $y = x^2 + 3x - 3$

The line **L** has equation $y - 5x + 4 = 0$

Show, algebraically, that **C** and **L** have exactly one point in common.

$$L \qquad y = 5x - 4 \qquad\qquad C \qquad y = x^2 + 3x - 3$$

Intersect where:

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

$$0 = x^2 - 2x + 1$$

$$0 = (x - 1)^2$$

$$\underline{\underline{x = 1}}$$

There is only 1 solution ∴ only 1 intersection

(Total for Question 16 is 4 marks)

Turn over ▶

17 x is directly proportional to the square of y.
y is directly proportional to the cube of z.

$z = 2$ when $x = 32$

Find a formula for x in terms of z.

$$x = ky^2 \qquad y = az^3$$

$$x = k(az^3)^2$$

$$x = k(a^2 z^6)$$

$$x = \boxed{ka^2} z^6$$

$\boxed{ka^2}$ is a constant (a number we need to work out)

when $x = 32 \quad z = 2$
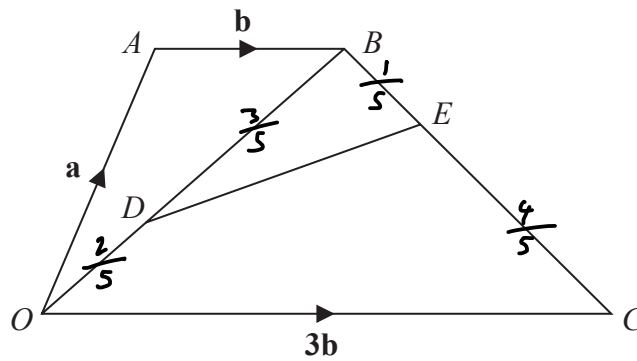
$$32 = \boxed{ka^2}(2)^6$$

$$32 = 64\boxed{ka^2}$$

$$\frac{1}{2} = \boxed{ka^2}$$

$$x = \frac{1}{2} z^6$$

(Total for Question 17 is 4 marks)

18 *OABC* is a trapezium.

$\overrightarrow{OA}$ = **a**
$\overrightarrow{AB}$ = **b**
$\overrightarrow{OC}$ = **3b**

D is the point on *OB* such that *OD* : *DB* = 2 : 3
E is the point on *BC* such that *BE* : *EC* = 1 : 4

Work out the vector $\overrightarrow{DE}$ in terms of **a** and **b**.
Give your answer in its simplest form.

$$\overrightarrow{OB} = a + b \qquad \overrightarrow{BC} = -b - a + 3b$$
$$= 2b - a$$

$$\overrightarrow{DE} = \frac{3}{5}\overrightarrow{OB} + \frac{1}{5}\overrightarrow{BC}$$

$$= \frac{3}{5}(a+b) + \frac{1}{5}(2b - a)$$

$$= \frac{3}{5}a + \frac{3}{5}b + \frac{2}{5}b - \frac{1}{5}a$$

$$= \frac{2}{5}a + b$$

$$\frac{2}{5}a + b$$

(Total for Question 18 is 4 marks)

P 6 4 6 3 4 A 0 1 9 2 4

19 At the start of year n, the number of animals in a population is P_n

At the start of the following year, the number of animals in the population is P_{n+1} where

$$P_{n+1} = kP_n$$

At the start of 2017 the number of animals in the population was 4000
At the start of 2019 the number of animals in the population was 3610

Find the value of the constant k.

$$P_{2018} = k(4000)$$
$$= 4000k$$

$$P_{2019} = k(4000k)$$
$$3610 = 4000k^2$$
$$\frac{361}{400} = k^2$$
$$k = \sqrt{\frac{361}{400}}$$
$$= 0.95$$

..........0.95..........

(Total for Question 19 is 3 marks)

20 Pat throws a fair coin n times.

Find an expression, in terms of n, for the probability that Pat gets at least 1 head and at least 1 tail.

1 time
$$P(H) = \frac{1}{2}$$
$$P(T) = \frac{1}{2}$$

2 times
$$P(HH) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$
$$P(TT) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$
$$1 - \frac{1}{4} - \frac{1}{4} = \frac{1}{2}$$

3 times
$$P(HHH) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$$
$$P(TTT) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$$
$$1 - \frac{1}{8} - \frac{1}{8} = \frac{6}{8}$$

n times
$$P(\text{All heads}) = \left(\frac{1}{2}\right)^n$$
$$P(\text{All tails}) = \left(\frac{1}{2}\right)^n$$

..........$1 - 2\left(\frac{1}{2}\right)^n$..........

(Total for Question 20 is 2 marks)

21 Here is a speed-time graph showing the speed, in metres per second, of an object t seconds after it started to move from rest.
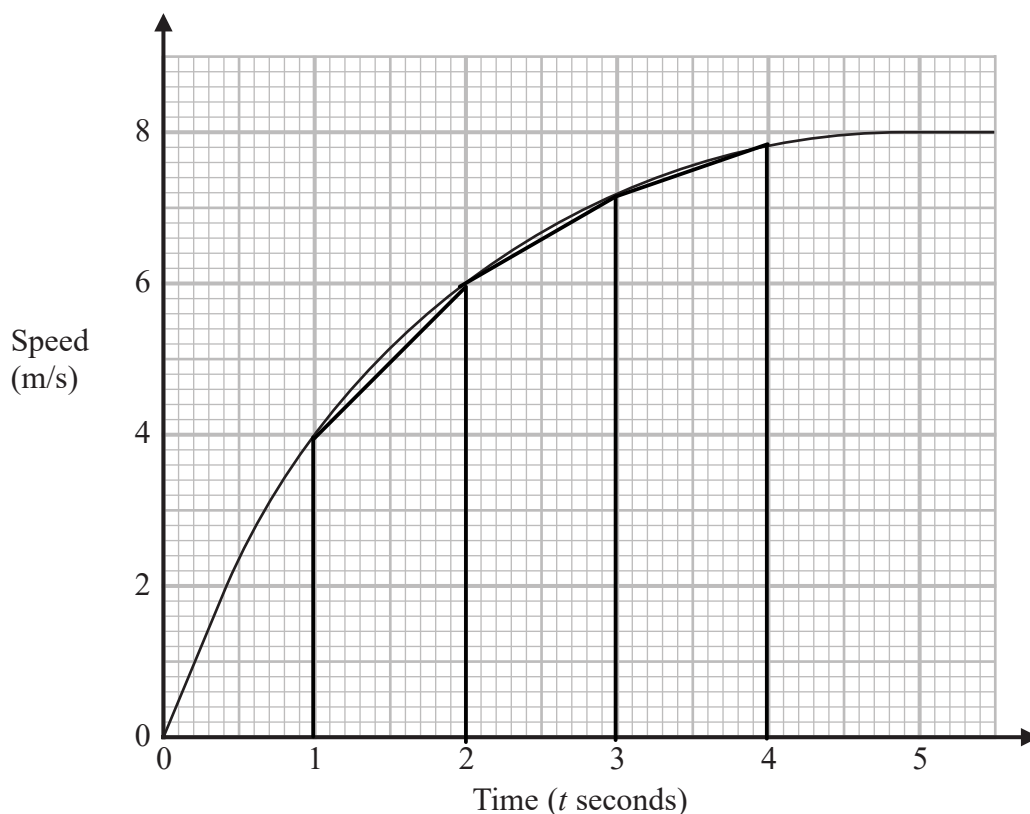
(a) Using 3 trapeziums of equal width, work out an estimate for the area under the graph between $t = 1$ and $t = 4$

$1 \times \dfrac{4+6}{2} = 5$

$1 \times \dfrac{6+7.2}{2} = 6.6$

$1 \times \dfrac{7.2+7.8}{2} = 7.5$

$5 + 6.6 + 7.5 = 19.1$

............................19.1............................

(3)

(b) What does this area represent?

The distance travelled (between 1 and 4 seconds)

(1)

(Total for Question 21 is 4 marks)

Turn over ▶

22 Show that $\dfrac{6x^3}{(9x^2 - 144)}$ $\dfrac{2x^4}{3(x-4)}$ can be written in the form $\dfrac{1}{x(x+r)}$ where r is

an integer.

$$\frac{6x^3}{(3x+12)(3x-12)} \times \frac{3(x-4)}{2x^4}$$

$$\frac{6x^3}{3(x+4) \cdot 3(x-4)} \times \frac{3(x-4)}{2x^4}$$

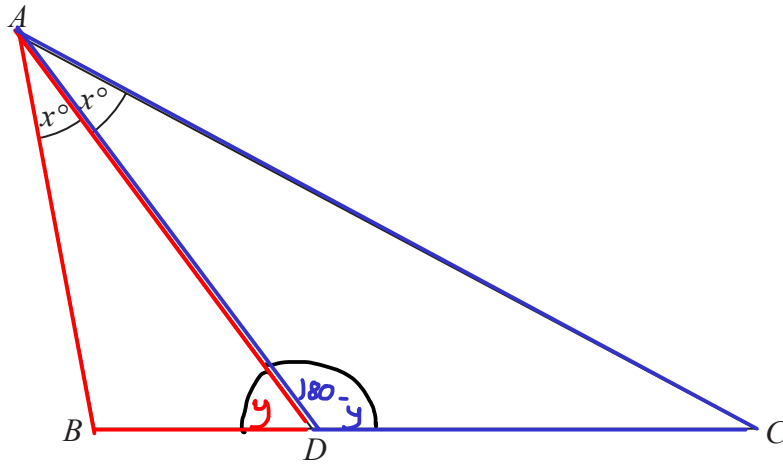$$\frac{6x^3}{9(x+4)(x-4)} \times \frac{3(x-4)}{2x^4}$$

$$\frac{\cancel{18}\cancel{x^3}(\cancel{x-4})\;1}{\cancel{18}x^4(\cancel{x-4})(x+4)}$$

$$\frac{1}{x(x+4)}$$

(Total for Question 22 is 3 marks)

23 *ABC* is a triangle.

D is the point on *BC* such that angle *BAD* = angle *DAC* = *x*°

$$\sin(y) = \sin(180 - y)$$

Prove that $\dfrac{AB}{BD} = \dfrac{AC}{DC}$

$$\frac{BD}{\sin x} = \frac{AB}{\sin y}$$

$$\frac{\sin y}{\sin x} = \frac{AB}{BD}$$

$$\frac{DC}{\sin x} = \frac{AC}{\sin(180 - y)}$$

$$\frac{\sin(180 - y)}{\sin x} = \frac{AC}{DC}$$

as $\sin(180 - y) = \sin y$

$$\frac{\sin y}{\sin x} = \frac{AC}{DC}$$

$$\frac{\sin y}{\sin x} = \frac{AC}{DC} = \frac{AB}{BD}$$

(Total for Question 23 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS

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