



0580/21

May/June 2022

1 Write down a prime number between 30 and 40.



..... 31 [1]

2 Calculate $4^5 - 5^4$.



..... 399 [1]

3 Jason starts a run at 10.05 am and finishes at 1.02 pm.



Work out the time Jason takes to complete the run.

$$\begin{array}{r}
 10:05 \rightarrow 11:00 \rightarrow 13:02 \\
 55' \quad + \quad 2h02' = 2h57'
 \end{array}$$

..... 2 h 57 min [1]

4 Calculate $\frac{1-0.7}{0.45-0.38}$, giving your answer correct to 4 significant figures.



≈ 4.28571

..... 4.286 [2]

5 Kirsty changes \$380.80 into pounds (£) when £1 = \$1.19.

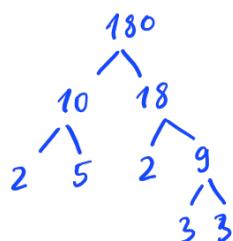


Calculate the amount Kirsty receives.

$$\frac{380.80}{1.19}$$

£ 320 [2]

6 Write 180 as a product of its prime factors.



..... $2^2 \times 3^2 \times 5$ [2]

7 Without using a calculator, work out $\frac{3}{7} - \frac{2}{21}$.



You must show all your working and give your answer as a fraction in its simplest form.

$$\frac{9}{21} - \frac{2}{21} = \frac{7}{21} = \frac{1}{3}$$

$$\dots \frac{1}{3} \dots [2]$$

8 $s = \frac{1}{2}at^2$



(a) Work out the value of s when $a = 0.9$ and $t = 4$.

$$s = \frac{1}{2} \times 0.9 \times 4^2$$

$$s = \dots 7.2 \dots [1]$$

(b) Rearrange the formula to find t in terms of s and a .

$$2s = at^2$$

$$\frac{2s}{a} = t^2$$

$$t = \dots \pm \sqrt{\frac{2s}{a}} \dots [2]$$

9 Factorise completely.



$$14xy - 7y^2$$

$$7y(2x - y)$$

$$\dots 7y(2x - y) \dots [2]$$

10

22, $\underbrace{\quad}_{-5}$ 17, $\underbrace{\quad}_{-5}$ 12, $\underbrace{\quad}_{-5}$ 7, $\underbrace{\quad}_{-5}$ 2, $\underbrace{\quad}_{-5}$...

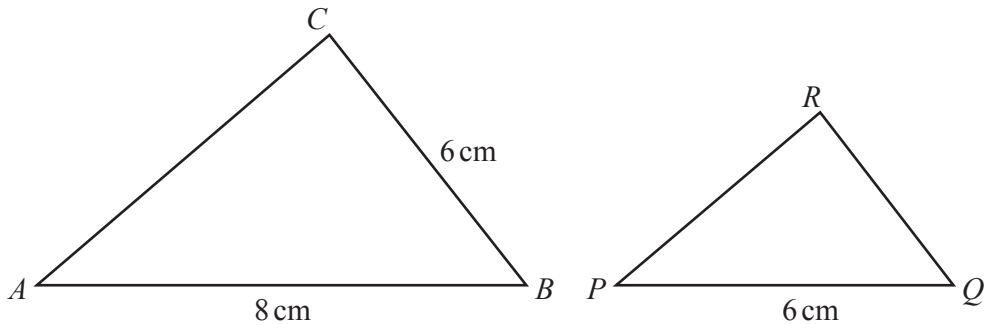
(a) Find the next term of the sequence.

..... -3 [1]

(b) Find the n th term of the sequence.

..... $-5n + 27$ [2]

11



NOT TO SCALE

Triangle ABC is mathematically similar to triangle PQR .(a) Calculate QR .

$$\frac{AB}{PQ} = \frac{BC}{QR} \Rightarrow \frac{8}{6} = \frac{6}{QR}$$

$$\Rightarrow QR = \frac{6 \times 6}{8}$$

$QR = \dots 4.5 \dots$ cm [2]

(b) The two triangles are the cross-sections of two mathematically similar prisms. The volume of the larger prism is 320 cm^3 .

Calculate the volume of the smaller prism.

$$\frac{V_{\text{large}}}{V_{\text{small}}} = \left(\frac{AB}{PQ}\right)^3 = \left(\frac{8}{6}\right)^3 = \frac{64}{27}$$

$$\Rightarrow V_{\text{small}} = 320 \div \frac{64}{27} = 135$$

..... 135 cm^3 [2]

- 12 The interior angles of a pentagon are in the ratio $4 : 5 : 5 : 7 : 9$.

(R) Find the size of the largest angle.

$$\text{sum of all angles} = (5-2) \times 180^\circ = 540^\circ$$

$$\text{largest angle} = \frac{9}{4+5+5+7+9} \times 540^\circ = 162^\circ$$

..... 162° [3]

- 13 Work out $2 \times 10^{100} - 2 \times 10^{98}$, giving your answer in standard form.

(R)

$$\begin{aligned} & 200 \times 10^{98} - 2 \times 10^{98} \\ &= (200 - 2) 10^{98} \\ &= 198 \times 10^{98} \\ &= 1.98 \times 10^{100} \end{aligned}$$

..... 1.98×10^{100} [2]

- 14 A train passes through a station at a speed of 108 km/h.

(R) The length of the station is 120 m.
The train takes 7 seconds to completely pass through the station.

Work out the length of the train.



$$\frac{108 \text{ km}}{\text{h}} = \frac{108 \times 10^3 \text{ m}}{3600 \text{ s}} = 30 \text{ m/s}$$

when the train completely passes through the station,
it has travelled the distance = length_{train} + length_{station}

$$\Rightarrow 7 \times 30 = \text{length}_{\text{train}} + 120$$

$$\Rightarrow \text{length}_{\text{train}} = 90$$

..... 90 m [3]

15 $4^x = \frac{1}{64}$

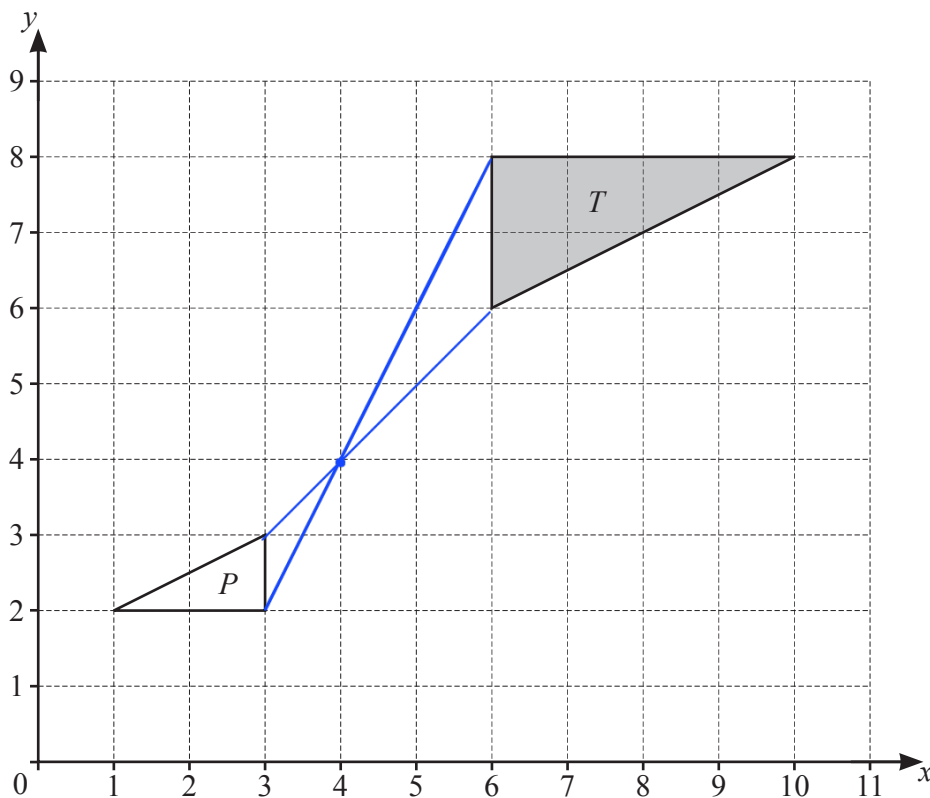
(R) Find the value of x .

$$4^x = \frac{1}{4^3} = 4^{-3}$$

$x = \dots -3 \dots [1]$

16

(R)



Describe fully the **single** transformation that maps triangle T onto triangle P .

\dots Enlargement, center $(4, 4)$, scale factor $-\frac{1}{2}$ \dots

\dots [3]

17 Find the radius of a hemisphere of volume 80 cm^3 .

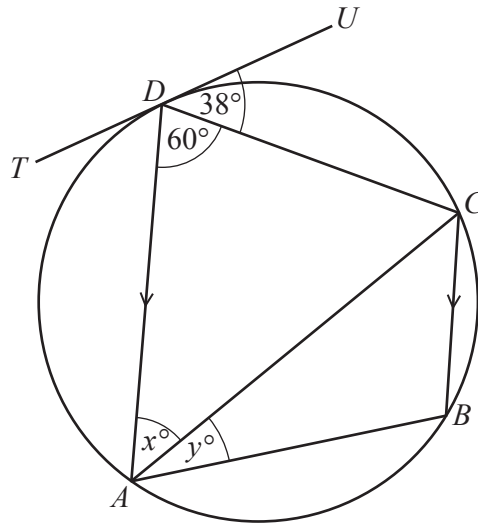
(R)

$$V_{\text{hemisphere}} = \frac{1}{2} \times \frac{4}{3} \pi r^3 = 80$$

$$\Rightarrow r^3 = \frac{120}{\pi}$$

$$\Rightarrow r = \sqrt[3]{\frac{120}{\pi}}$$

$\dots 3.37 \dots \text{ cm [3]}$



NOT TO
SCALE

A , B , C and D are points on a circle.
 TU is a tangent to the circle at D .
 DA is parallel to CB .

Find the value of x and the value of y .

$$\widehat{CBA} = 180^\circ - \widehat{CDA} = 180^\circ - 60^\circ = 120^\circ$$

$$\widehat{DAB} = 180^\circ - \widehat{CBA} = 180^\circ - 120^\circ = 60^\circ$$

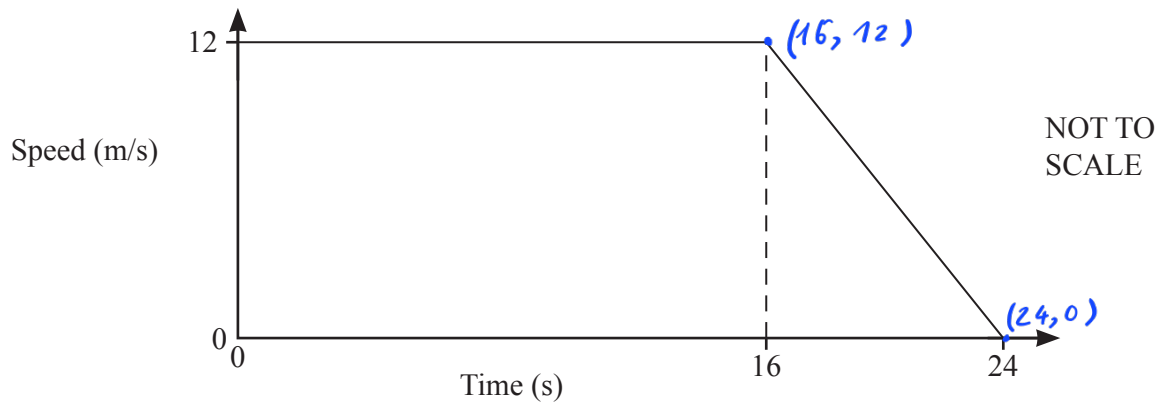
$$y = 60^\circ - 38^\circ = 22^\circ$$

$$x = \dots 38^\circ \dots$$

$$y = \dots 22^\circ \dots [3]$$

20

7



The diagram shows the speed–time graph for 24 seconds of a car journey.

Calculate

- (a) the deceleration of the car in the final 8 seconds,

$$\text{gradient} = \frac{0 - 12}{24 - 16} = -1.5$$

..... 1.5 m/s² [1]

- (b) the total distance travelled during the 24 seconds.

$$\begin{aligned} \text{Total distance} &= \text{Area of trapezium} \\ &= \frac{1}{2} (16 + 24) \times 12 \end{aligned}$$

..... 240 m [2]

- 21 Factorise completely.

7

$$\begin{aligned} &1 - q - a + aq \\ &(1 - q) - a(1 - q) \\ &(1 - q)(1 - a) \end{aligned}$$

..... (1 - q)(1 - a) [2]

22 Simplify fully $(216y^{216})^{\frac{2}{3}}$.

7

$$216^{\frac{2}{3}} (y^{216})^{\frac{2}{3}}$$

$$\left(\sqrt[3]{216}\right)^2 y^{216 \times \frac{2}{3}} = 6^2 y^{144}$$

..... $36 y^{144}$ [2]

23 $x^2 + 8x + 10 = (x+p)^2 + q$

7

(a) Find the value of p and the value of q .

$$(x^2 + 2x4 + 4^2) - 4^2 + 10$$

$$(x + 4)^2 - 6$$

$p = \dots 4 \dots$

$q = \dots -6 \dots$ [2]

(b) Solve.

$$x^2 + 8x + 10 = 30$$

$$(x + 4)^2 - 6 = 30$$

$$(x + 4)^2 = 36$$

$$x + 4 = 6 \text{ or } x + 4 = -6$$

$$x = 2 \text{ or } x = -10$$

$x = \dots 2 \dots$ or $x = \dots -10 \dots$ [2]

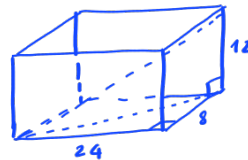
24 A cuboid measures 24 cm by 12 cm by 8 cm.

7

Calculate the length of a diagonal of the cuboid.

$$24^2 + 8^2 = 640$$

$$\sqrt{640 + 12^2} = 28$$



..... 28 cm [3]

25 w is proportional to the square root of y .

y is inversely proportional to x .

When $x = 4$, $y = 16$ and $w = 8$.

Find w in terms of x .

$$w \propto \sqrt{y} \Rightarrow w = k\sqrt{y}$$

$$8 = k\sqrt{16} \Rightarrow k = 8 : 4 = 2 \Rightarrow w = 2\sqrt{y} \quad (1)$$

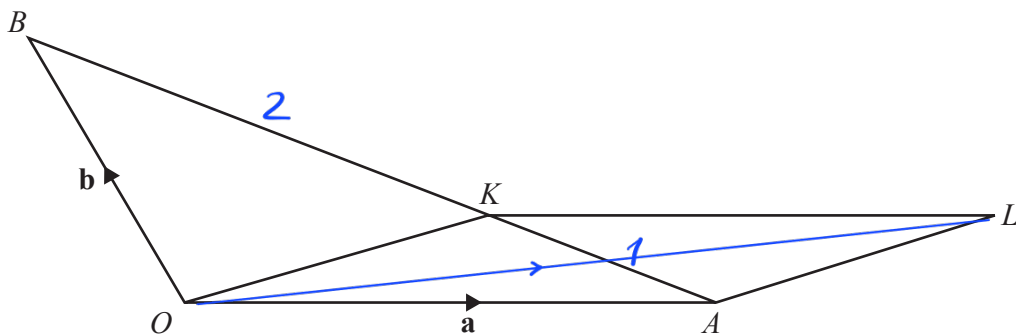
$$y \propto \frac{1}{x} \Rightarrow y = \frac{m}{x}$$

$$16 = \frac{m}{4} \Rightarrow m = 64 \Rightarrow y = \frac{64}{x} \quad (2)$$

$$(1), (2) \Rightarrow w = 2\sqrt{\frac{64}{x}} = \frac{2\sqrt{64}}{\sqrt{x}} \quad w = \frac{16}{\sqrt{x}} \quad [3]$$

26

\mathcal{R}



NOT TO
SCALE

The diagram shows a triangle OAB and a parallelogram $OALK$.

The position vector of A is \mathbf{a} and the position vector of B is \mathbf{b} .

K is a point on AB so that $AK : KB = 1 : 2$.

Find the position vector of L , in terms of \mathbf{a} and \mathbf{b} .

Give your answer in its simplest form.

$$\vec{AB} = \vec{AO} + \vec{OB} = -\mathbf{a} + \mathbf{b}$$

$$\vec{AK} = \frac{1}{3} \vec{AB} = \frac{1}{3} (-\mathbf{a} + \mathbf{b})$$

$$\vec{OK} = \vec{OA} + \vec{AK} = \mathbf{a} + \frac{1}{3} (-\mathbf{a} + \mathbf{b}) = \frac{2}{3} \mathbf{a} + \frac{1}{3} \mathbf{b}$$

$$\vec{AL} = \vec{OK} = \frac{2}{3} \mathbf{a} + \frac{1}{3} \mathbf{b} \quad (\text{OALK is a parallelogram})$$

$$\vec{OL} = \vec{OA} + \vec{AL} = \mathbf{a} + \frac{2}{3} \mathbf{a} + \frac{1}{3} \mathbf{b}$$

$$\dots \frac{5}{3} \mathbf{a} + \frac{1}{3} \mathbf{b} \dots [4]$$

27 The line $y = x + 1$ intersects the graph of $y = x^2 - 3x - 11$ at the points A and B .

7c

Find the coordinates of A and the coordinates of B .
You must show all your working.

$$x + 1 = x^2 - 3x - 11$$

$$x^2 - 4x - 12 = 0$$

$$x^2 + 2x - 6x - 12 = 0$$

$$x(x + 2) - 6(x + 2) = 0$$

$$(x - 6)(x + 2) = 0$$

$$x - 6 = 0 \quad \text{or} \quad x + 2 = 0$$

$$x = 6 \quad \text{or} \quad x = -2$$

When $x = 6$, $y = 6 + 1 = 7$

When $x = -2$, $y = -2 + 1 = -1$

$$A(\dots -2 \dots , \dots -1 \dots)$$

$$B(\dots 6 \dots , \dots 7 \dots) [4]$$