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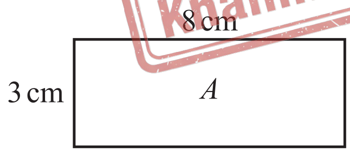
0580/21

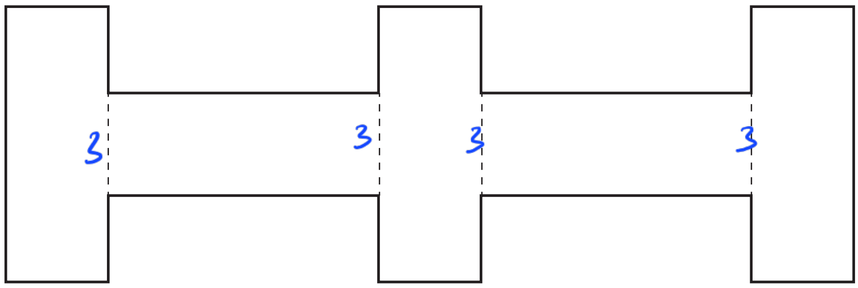
May/June 2020

1 Rectangle A measures 3 cm by 8 cm.



NOT TO SCALE

Five rectangles congruent to A are joined to make a shape.



NOT TO SCALE

Work out the perimeter of this shape.

$[2(8+3)] \times 5 - 8 \times 3$

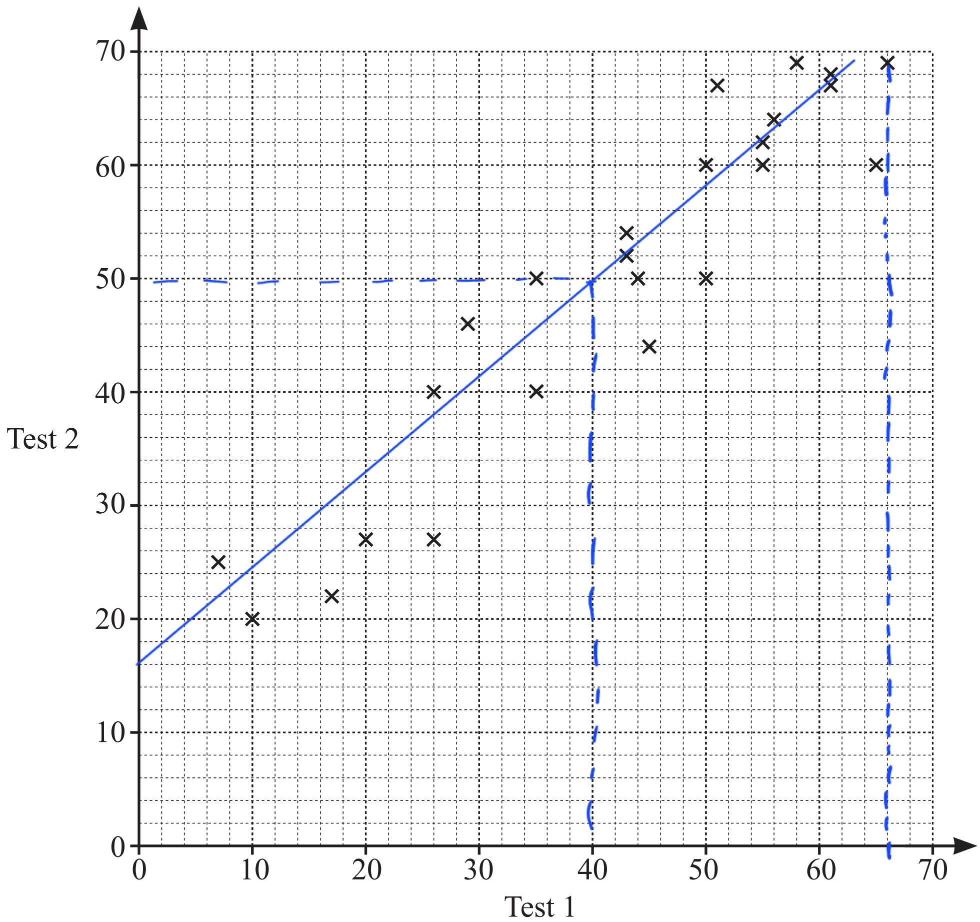
.........86......... cm [2]

2 Find the highest **odd** number that is a factor of 60 and a factor of 90.

Factors of 60: 60, 30, 15 ....

.........15......... [1]

3 Mrs Salaman gives her class two mathematics tests.
The scatter diagram shows information about the marks each student scored.



(a) Write down the highest mark scored on test 1.

................66................ [1]

(b) Write down the type of correlation shown in the scatter diagram.

................positive................ [1]

(c) Draw a line of best fit on the scatter diagram. [1]

(d) Hamish scored a mark of 40 on test 1.
He was absent for test 2.

Use your line of best fit to find an estimate for his mark on test 2.

................50................ [1]

4 A bag contains blue, red, yellow and green balls only.
A ball is taken from the bag at random.
The table shows some information about the probabilities.

Colour	Blue	Red	Yellow	Green
Probability	0.15	0.2	0.22	0.43

(a) Complete the table.

$1-(0.15+0.2+0.43)=0.22$

[2]

(b) Abdul takes a ball at random and replaces it in the bag.
He does this 200 times.

Find how many times he expects to take a red ball.

$200 \times 0.2 = 40$

.................40................. [1]

5 **(a)** The nth term of a sequence is $60-8n$.

Find the largest number in this sequence.

$n = 1, 2, 3 \ldots$

The number is largest when $n=1 \Rightarrow 60-8\times1=52$

.................52................. [1]

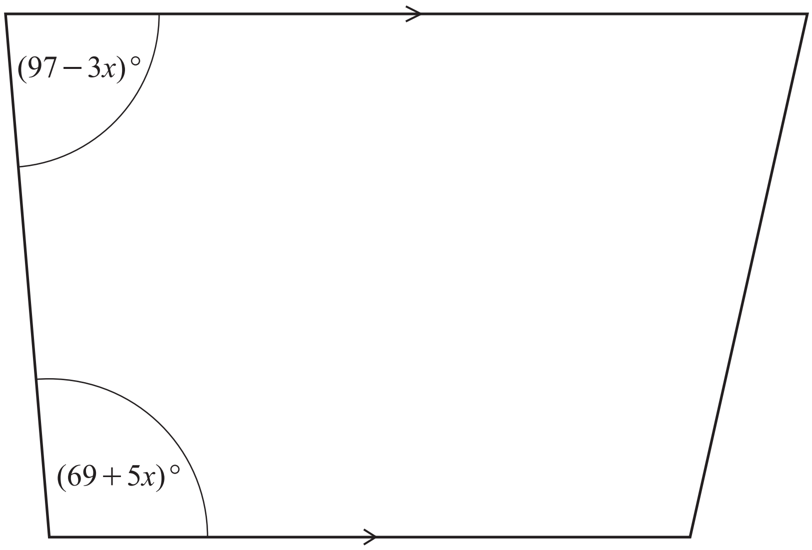
(b) Here are the first five terms of a different sequence.

$$\underbrace{12 \quad 19}_{+7}\ \underbrace{\quad 26}_{+7}\ \underbrace{\quad 33}_{+7}\ \underbrace{\quad 40}_{+7}$$

Find an expression for the nth term of this sequence.

.................$7n+5$................. [2]

6 The diagram shows a trapezium.



Work out the value of x.

$(97 - 3x) + (69 + 5x) = 180$ (interior angles)

$166 + 2x = 180$

$2x = 14$

$x = $ ......$7°$...... [3]

7 $234 = 2 \times 3^2 \times 13$ $1872 = 2^4 \times 3^2 \times 13$ $234 \times 1872 = 438\,048$

Use this information to write 438 048 as a product of its prime factors.

$438\,048 = 234 \times 1872$

$= (2 \times 3^2 \times 13) \times (2^4 \times 3^2 \times 13)$

$= (2 \times 2^4) \times (3^2 \times 3^2) \times (13 \times 13)$

......$2^5 \times 3^4 \times 13^2$...... [1]

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8 **Without using a calculator**, work out $\left(2\frac{1}{3}-\frac{7}{8}\right)\times\frac{6}{25}$.

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

$$\left(\frac{7}{3}-\frac{7}{8}\right)\times\frac{6}{25}$$

$$\frac{56-21}{24}\times\frac{6}{25}$$

$$\frac{35}{24}\times\frac{6}{25}$$

$$\frac{\cancel{5}\times 7\times\cancel{6}}{\cancel{6}\times 4\times\cancel{5}\times 5}$$

$\frac{7}{20}$ .... [4]

9 Factorise completely.

(a) $21a^2+28ab$

$7a(3a+4b)$ .... [2]

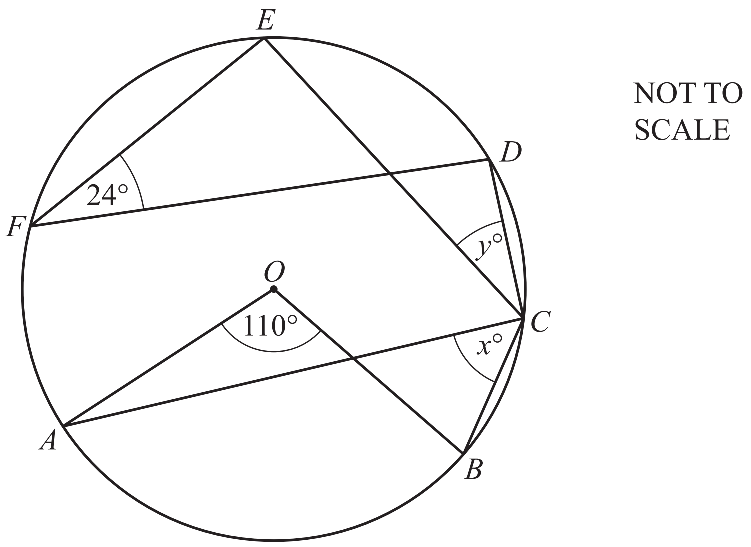
(b) $20x^2-45y^2$

$$5(4x^2-9y^2)$$

$$5[(2x)^2-(3y)^2]$$

$5(2x-3y)(2x+3y)$ .... [3]

10



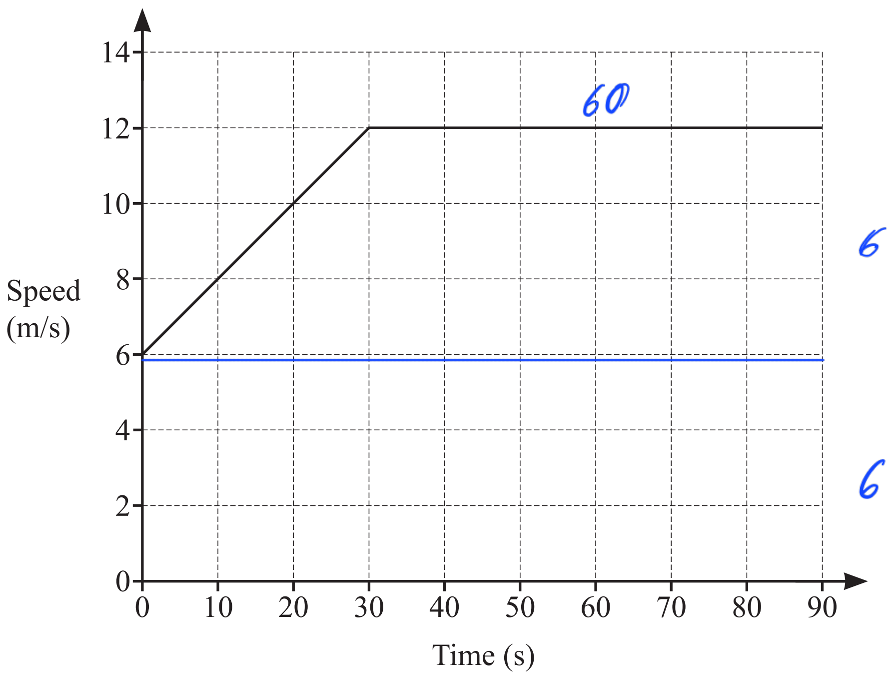
Points A, B, C, D, E and F lie on the circle, centre O.

Find the value of x and the value of y.

$x =$ ....55°........

$y =$ ....24°........ [2]

11



The diagram shows the speed–time graph for 90 seconds of a journey.

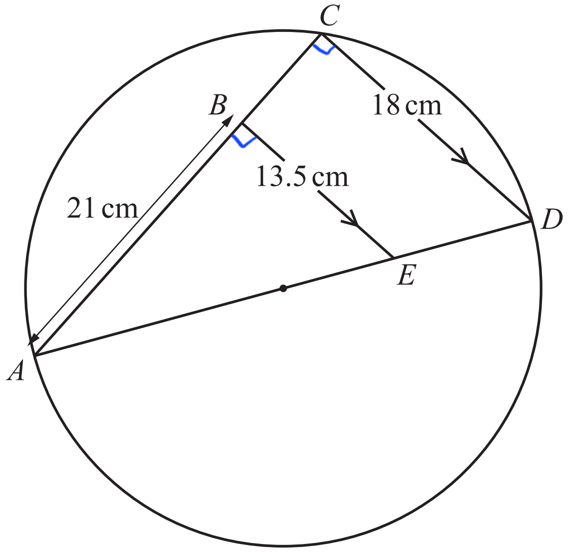
Calculate the total distance travelled during the 90 seconds.

Total distance = Area$_{\text{trapezium}}$ + Area$_{\text{rectangle}}$

$= \frac{60 + 90}{2} \times 6 + 6 \times 90$

........990........ m [3]

13



NOT TO SCALE

C lies on a circle with diameter *AD*.
B lies on *AC* and *E* lies on *AD* such that *BE* is parallel to *CD*.
AB = 21 cm, *CD* = 18 cm and *BE* = 13.5 cm.

Work out the radius of the circle.

$\triangle ABE \sim \triangle ACD$

$$\frac{AB}{AC} = \frac{BE}{CD}$$

$$\frac{21}{AC} = \frac{13.5}{18}$$

$$AC = \frac{21 \times 18}{13.5}$$

$$AD = \sqrt{28^2 + 18^2} = 2\sqrt{277}$$

radius $= \sqrt{277}$

.......16.6....... cm [5]

14 **(a)** $\mathrm{f}(x) = 4x + 3$ $\mathrm{g}(x) = 5x - 4$

$\mathrm{fg}(x) = 20x + p$

Find the value of p.

$\mathrm{fg}(x) = 4(5x - 4) + 3$

$= 20x - 13$

$p =$ ....-13............ [2]

(b) $\mathrm{h}(x) = \frac{5x - 1}{3}$

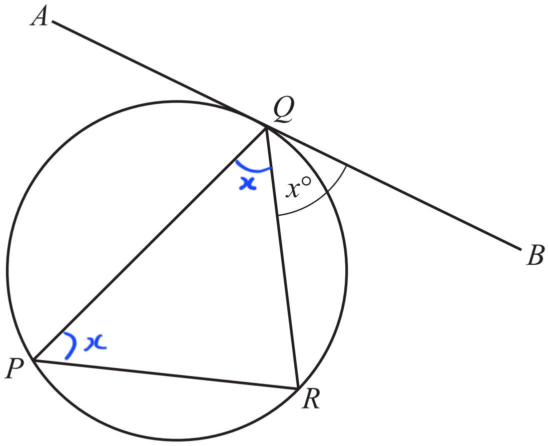
Find $\mathrm{h}^{-1}(x)$.

$\times 5 \rightarrow -1 \rightarrow \div 3$

$\div 5 \leftarrow +1 \leftarrow \times 3$

$\mathrm{h}^{-1}(x) =$ .... $\frac{3x+1}{5}$ .... [3]

15



P, R and Q are points on the circle.
AB is a tangent to the circle at Q.
QR bisects angle PQB.
Angle $BQR = x°$ and $x < 60$.

Use this information to show that triangle PQR is an isosceles triangle.
Give a geometrical reason for each step of your work.

$\widehat{PQR} = \widehat{BQR} = x°$ (QR bisects $\widehat{PQB}$)
$\widehat{QPR} = \widehat{BQR} = x°$ (alternate segment theorem)
$\Rightarrow \widehat{PQR} = \widehat{QPR} = x°$
$x < 60 \Rightarrow \Delta PQR$ can not be equilateral
$\Rightarrow \Delta PQR$ is an isosceles triangle

[3]

16 m is inversely proportional to the square of $(p-1)$.
When $p = 4$, $m = 5$.

Find m when $p = 6$.

$$m = \frac{k}{(p-1)^2}$$

$$5 = \frac{k}{(4-1)^2} \Rightarrow k = 5 \times 3^2 = 45$$

$$m = \frac{45}{(p-1)^2}$$

When $p = 6$: $m = \frac{45}{(6-1)^2} = 1.8$

$m =$ ....1.8........ [3]

17 (a) (i) $\mathbf{m} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$

Find 3**m**.

$3m = \begin{pmatrix} 3 \times 5 \\ 3 \times 7 \end{pmatrix}$

$\begin{pmatrix} 15 \\ 21 \end{pmatrix}$ [1]

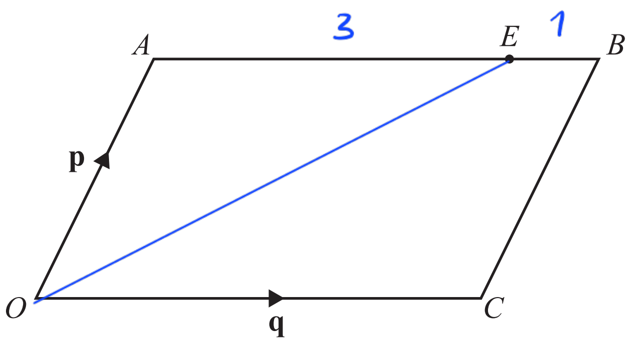
(ii) $\overrightarrow{VW} = \begin{pmatrix} 10 \\ -24 \end{pmatrix}$

Find $|\overrightarrow{VW}|$.

$|\overrightarrow{VW}| = \sqrt{10^2 + (-24)^2} = 26$

.................26................. [2]

(b)



NOT TO SCALE

OABC is a parallelogram.
$\overrightarrow{OA} = \mathbf{p}$ and $\overrightarrow{OC} = \mathbf{q}$.
E is the point on *AB* such that *AE* : *EB* = 3 : 1.

Find $\overrightarrow{OE}$, in terms of **p** and **q**, in its simplest form.

$\overrightarrow{AE} = \frac{3}{4}\overrightarrow{AB} = \frac{3}{4}\overrightarrow{OC} = \frac{3}{4}q$

$\overrightarrow{OE} = \overrightarrow{OA} + \overrightarrow{AE}$

$= p + \frac{3}{4}q$

$\overrightarrow{OE}$ = ...$p + \frac{3}{4}q$........ [2]

18 $P = 2(w + h)$

$w = 12$ correct to the nearest whole number.
$h = 4$ correct to the nearest whole number.

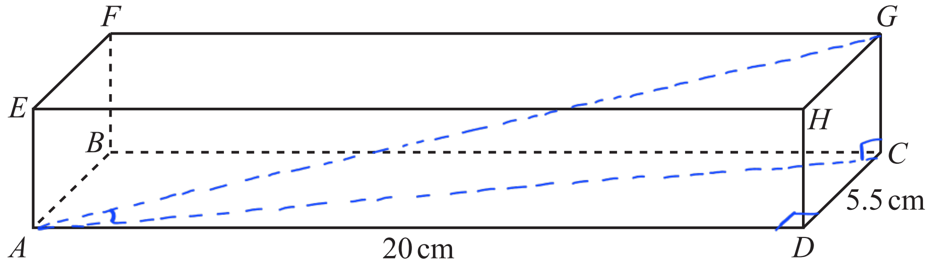
Work out the upper bound for the value of P.

P_{max} when w_{max} and h_{max}

$P_{max} = 2\left(12 + \frac{1}{2} + 4 + \frac{1}{2}\right)$

.................34................. [2]

19



NOT TO SCALE

The diagram shows cuboid $ABCDEFGH$ of length 20 cm and width 5.5 cm.
The volume of the cuboid is 495 cm^3.

Find the angle between the line AG and the base of the cuboid $ABCD$.

$GC = \frac{495}{20 \times 5.5} = 4.5$

$AC = \sqrt{20^2 + 5.5^2} \simeq 20.742$

$\tan \widehat{GAC} = \frac{GC}{AC} \simeq 0.2170$

$\widehat{GAC} = 12.2^\circ$

.................12.2°................. [5]

20 The curve $y = x^2 - 2x + 1$ is drawn on a grid.
A line is drawn on the same grid.
The points of intersection of the line and the curve are used to solve the equation $x^2 - 7x + 5 = 0$.

Find the equation of the line in the form $y = mx + c$.

$x^2 - 7x + 5 = 0$

$x^2 - 2x + 1 - 5x + 4 = 0$

$x^2 - 2x + 1 = 5x - 4$

$y =$ ......$5x - 4$...... [1]

21 Expand and simplify $(x+3)(x-5)(3x-1)$.

$(x^2 + 3x - 5x - 15)(3x - 1)$

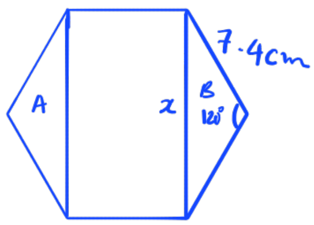
$(x^2 - 2x - 15)(3x - 1)$

$3x^3 - 6x^2 - 45x - x^2 + 2x + 15$

......$3x^3 - 7x^2 - 43x + 15$...... [3]

22 Find the area of a regular hexagon with side length 7.4 cm.

interior angle $= \dfrac{(6-2)\,180°}{6} = 120°$



Area of 2 triangles A, B:

$2 \times \frac{1}{2} \times 7.4 \times 7.4 \sin 120° \approx 47.424$

$x^2 = 7.4^2 + 7.4^2 - 2 \times 7.4 \times 7.4 \cos 120° = 164.28$

$x = \sqrt{164.28}$

$\Rightarrow$ Area of hexagon $= 47.424 + \sqrt{164.28} \times 7.4$

......142...... cm^2 [3]

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