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1 32 33 34 35 36 37 38 39

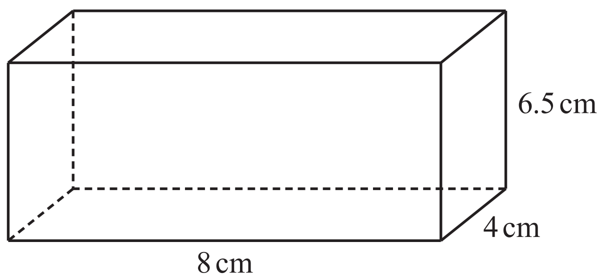
From this list of numbers, write down

(a) a multiple of 8, ...32.......... [1]

(b) a square number, ...36.......... [1]

(c) a prime number. ....37.......... [1]

2



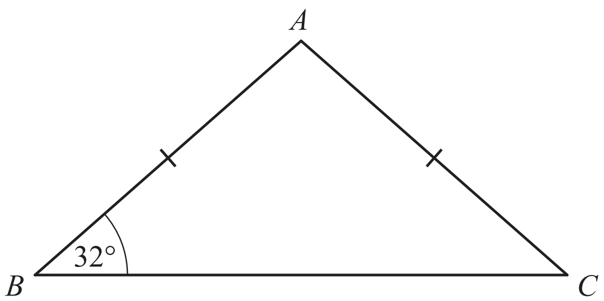
NOT TO SCALE

The diagram shows a cuboid.
Calculate the volume of the cuboid.

$V = 8 \times 4 \times 6.5$

..........208.......... cm^3 [1]

3



NOT TO SCALE

Triangle *ABC* is isosceles.
Angle *ABC* = 32° and *AB* = *AC*.

Find angle *BAC*.

$\widehat{ACB} = = \widehat{ABC} = 32^\circ$

$\widehat{BAC} = 180^\circ - 2 \times 32^\circ$

Angle *BAC* = ...116°.......... [2]

4 A train journey takes 5 hours 54 minutes.

(a) The journey starts at 09 15.

Find the time that the journey ends.

9h 15 + 5h 54 = 14h 69 = 15h 09

........15 : 09........ [1]

(b) The average speed of the train for this journey is 80 km/h.

Calculate the distance travelled.

$5h\ 54' = \left(5 + \frac{54}{60}\right)h = 5.9h$

distance = 80×5.9

........472........ km [2]

5 Sofia has a bag containing 8 blue beads and 7 red beads only.
She takes one bead out of the bag at random and replaces it.
She does this 90 times.

Find the number of times she expects to take a red bead.

$P(\text{red}) = \frac{7}{8+7} = \frac{7}{15}$

$90 \times \frac{7}{15} = 42$

........42........ [2]

6 Simplify.

(a) $p^2 \times p^4$

........p^6........ [1]

(b) $m^{15} \div m^5$

........m^{10}........ [1]

(c) $(k^3)^5$

........k^{15}........ [1]

7 **Without using a calculator**, work out $3\frac{1}{4} - 2\frac{2}{3}$.

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

$$\frac{13}{4} - \frac{8}{3}$$

$$\frac{13 \times 3 - 8 \times 4}{4 \times 3} = \frac{7}{12}$$

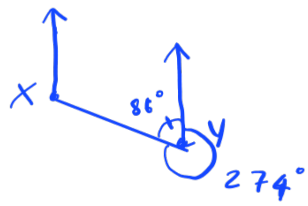
.............$\frac{7}{12}$............. [3]

8 The bearing of *X* from *Y* is 274°.

Calculate the bearing of *Y* from *X*.

$360° - 274° = 86°$

$180° - 86° = 94°$



.............094°............. [2]

9 Calculate the area of the sector of a circle with radius 65 mm and sector angle 42°.

Give your answer in square centimetres.

$65\ mm = 6.5\ cm$

$42° = \frac{42\pi}{180}\ rad$

$$Area_{sector} = \frac{1}{2}\, 6.5^2 \times \frac{42\pi}{180}$$

$$\approx 15.5$$

.............15.5............. cm^2 [3]

10 A solid cylinder has radius 3 cm and height 4.5 cm.

Calculate the **total** surface area of the cylinder.

$$\underbrace{\pi 3^2 \times 2}_{\text{2 bases}} + \underbrace{2\pi 3 \times 4.5}_{\text{curved}}$$

$$= 45\pi$$

$$\approx 141$$

.......141....................... cm^2 [4]

11 y is directly proportional to the cube root of $(x+3)$.

When $x = 5$, $y = \frac{2}{3}$.

Find y when $x = 24$.

$$y = k\sqrt[3]{x+3}$$

$$\frac{2}{3} = k\sqrt[3]{5+3} \quad \Rightarrow k = \frac{1}{3}$$

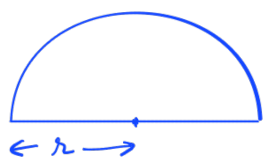
$$y = \frac{1}{3}\sqrt[3]{x+3}$$

when $x = 24$, $y = \frac{1}{3}\sqrt[3]{24+3} = 1$

$y =$ ....1....................................... [3]

12 The total perimeter of a semicircle is 19.02 cm.

Calculate the radius of the semicircle.



$$2r + \frac{2\pi r}{2} = 19.02$$

$$2r + \pi r = 19.02$$

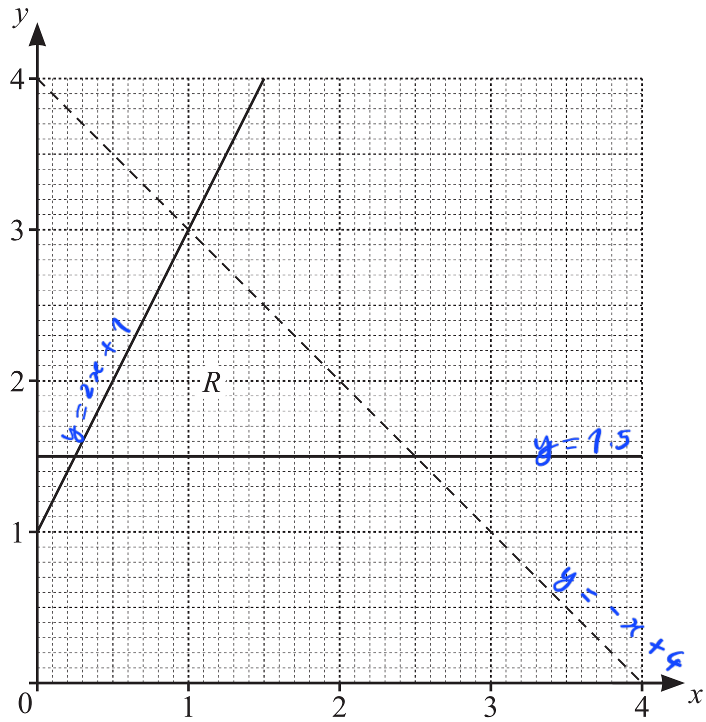
$$(2+\pi)r = 19.02$$

$$r = \frac{19.02}{2+\pi}$$

$$r \approx 3.70$$

.....3.70............................ cm [3]

13



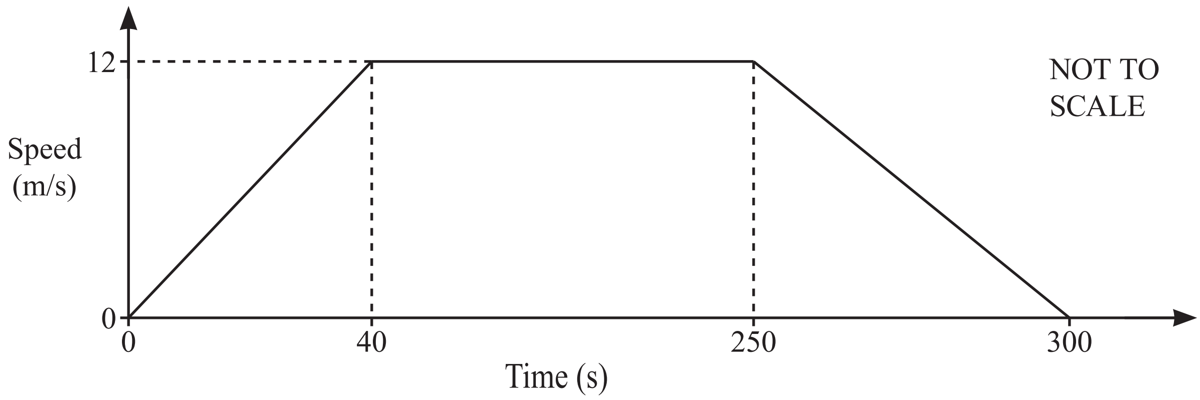
Write down the three inequalities that define the region R.

$y < -x + 4$

$y \geqslant 1.5$

$y \leqslant 2x + 1$ [4]

14 The diagram shows the speed–time graph of a train journey between two stations.



(a) Find the acceleration of the train during the first 40 seconds.

$\frac{12}{40}$

0.3 m/s^2 [1]

(b) Calculate the distance between the two stations.

$\frac{1}{2} \times 12 \times 40 + (250 - 40) 12 + \frac{1}{2} \times 12 (300 - 250)$

3060 m [3]

15 The table shows the amount of money, \$$x$, given to a charity by each of 60 people.

Mid value	10	22.5	30	42.5	75
Amount (\$$x$)	$0 < x \leqslant 20$	$20 < x \leqslant 25$	$25 < x \leqslant 35$	$35 < x \leqslant 50$	$50 < x \leqslant 100$
Frequency	21	16	6	10	7

Calculate an estimate of the mean.

$$\frac{10 \times 21 + 22.5 \times 16 + 30 \times 6 + 42.5 \times 10 + 75 \times 7}{60}$$

........................28.3........................ [4]

16 Paddy and Anna each invest \$2000 for 5 years.
Paddy earns simple interest at a rate of 1.25% per year.
Anna earns compound interest at a rate of r% per year.
At the end of 5 years, Paddy's investment is worth the same as Anna's investment.
Calculate the value of r.

After 5 years: Paddy = Anna

$$2000 + 2000 \times \frac{1.25}{100} \times 5 = 2000\left(1 + \frac{r}{100}\right)^5$$

$$2125 = 2000\left(1 + \frac{r}{100}\right)^5$$

$$1 + \frac{r}{100} = \sqrt[5]{\frac{2125}{2000}}$$

$$\frac{r}{100} = 0.0122$$

r = ...1.22.......................... [5]

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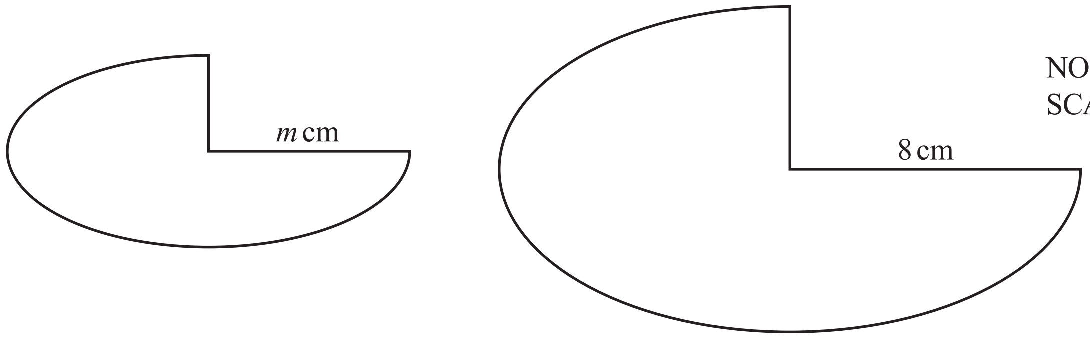
17



NOT TO SCALE

The diagram shows two shapes that are mathematically similar.
The smaller shape has area $52.5\,\text{cm}^2$ and the larger shape has area $134.4\,\text{cm}^2$.

Calculate the value of m.

$$\text{Ratio}_{\text{area}} = (\text{ratio side})^2$$

$$\Rightarrow \frac{52.5}{134.4} = \left(\frac{m}{8}\right)^2 = \frac{m^2}{64}$$

$$m^2 = 25$$

$$m > 0 \Rightarrow m = 5$$

$m =$ ......5...................................... [3]

18 (a) Write $x^2 - 18x - 27$ in the form $(x+k)^2 + h$.

$$(x^2 - 2x9 + 9^2) - 9^2 - 27$$

$$(x-9)^2 - 108$$

......$(x-9)^2 - 108$...... [2]

(b) Use your answer to **part (a)** to solve the equation $x^2 - 18x - 27 = 0$.

$$(x-9)^2 - 108 = 0$$

$$(x-9)^2 = 108$$

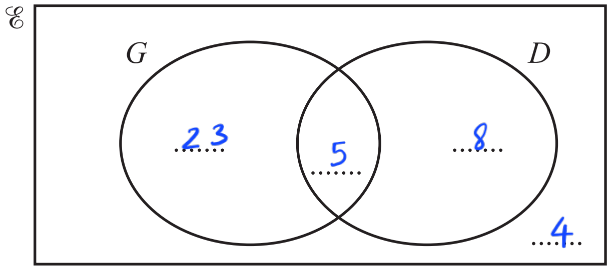
$$x - 9 = \pm\sqrt{108}$$

$$x = \pm\sqrt{108} + 9$$

$x =$ ......19.4...... or $x =$ ......−1.39...... [2]

19 (a) In a class of 40 students:

- 28 wear glasses (G)
- 13 have driving lessons (D)
- 4 do not wear glasses and do not have driving lessons.

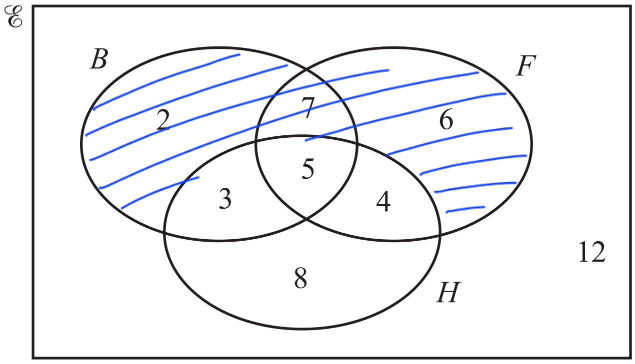


(i) Complete the Venn diagram. [2]

(ii) Use set notation to describe the region that contains a total of 32 students.

$G \cup D'$ [1]

(b) This Venn diagram shows information about the number of students who play basketball (B), football (F) and hockey (H).

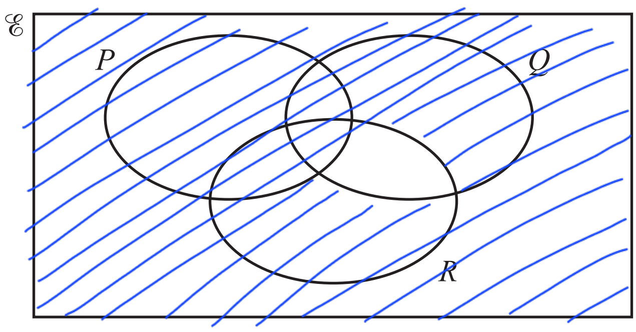


Find $n((B \cup F) \cap H')$.

$2 + 7 + 6$

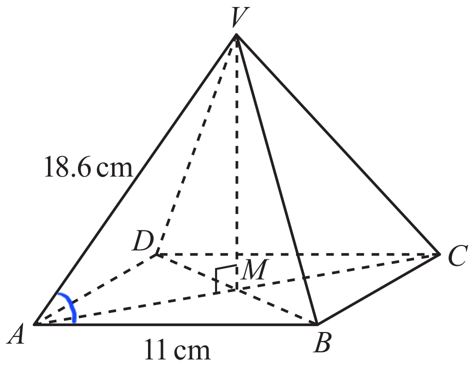
15 [1]

(c)



Shade the region $P \cup (Q \cap R)'$. [1]

20



NOT TO SCALE

The diagram shows a pyramid with a square base *ABCD*.
The diagonals *AC* and *BD* intersect at *M*.
The vertex *V* is vertically above *M*.
AB = 11 cm and *AV* = 18.6 cm.

Calculate the angle that *AV* makes with the base.

$$AC = \sqrt{AB^2 + BC^2} = \sqrt{11^2 + 11^2} = 11\sqrt{2}$$

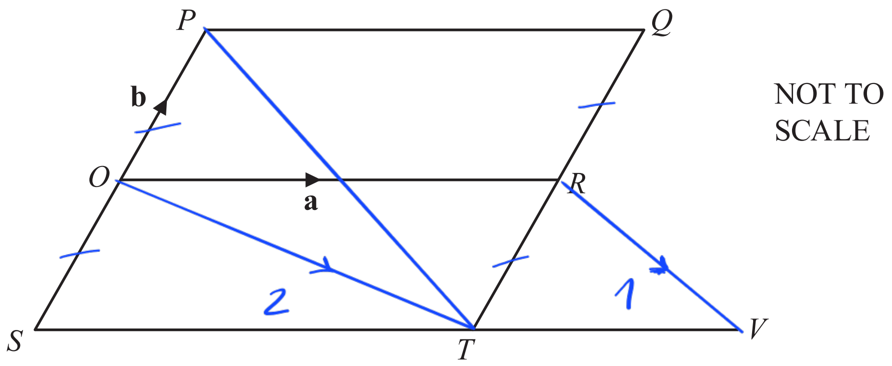
$$AM = \frac{11\sqrt{2}}{2} = \frac{11}{\sqrt{2}}$$

$$\cos \widehat{VAM} = \frac{AM}{VA} = \frac{11}{\sqrt{2}} : 18.6$$

$$\widehat{VAM} \approx 65.3°$$

..........65.3°.......... [4]

21



O is the origin and $OPQR$ is a parallelogram.
SOP is a straight line with $SO = OP$.
TRQ is a straight line with $TR = RQ$.
STV is a straight line and $ST : TV = 2 : 1$.
$\overrightarrow{OR} = \mathbf{a}$ and $\overrightarrow{OP} = \mathbf{b}$.

(a) Find, in terms of **a** and **b**, in its simplest form,

(i) the position vector of T,

$\overrightarrow{TR} = \overrightarrow{SO} = \overrightarrow{OP} = b$

$\overrightarrow{OT} = \overrightarrow{OR} + \overrightarrow{RT} = a - b$

.............$a - b$............. [2]

(ii) $\overrightarrow{RV}$.

$\overrightarrow{TV} = \frac{1}{2}\overrightarrow{ST} = \frac{1}{2}\overrightarrow{OR} = \frac{1}{2}a$

$\overrightarrow{RV} = \overrightarrow{RT} + \overrightarrow{TV} = -b + \frac{1}{2}a$

$\overrightarrow{RV}$ = ...$-b + \frac{1}{2}a$............. [1]

(b) Show that PT is parallel to RV.

$\overrightarrow{PT} = \overrightarrow{PS} + \overrightarrow{ST}$

$\overrightarrow{PT} = -2b + a$

$\overrightarrow{PT} = 2\overrightarrow{RV}$

$\Rightarrow PT \parallel RV$

[2]