National 5 Mathematics

2021 Paper 2

Time allowed = 1 hr 50 mins Marks available = 60

For each question, you can click on the link to view the worked solutions for each question.

Remember to record your percentage for this paper in your analysis grid (your score ÷ 60 × 100).

FORMULAE LIST

The roots of $ax^2+bx+c=0$ are $x=\dfrac{-b\pm\sqrt{(b^2-4ac)}}{2a}$

Sine rule $\dfrac{a}{\sin A}=\dfrac{b}{\sin B}=\dfrac{c}{\sin C}$

Cosine rule $a^2=b^2+c^2-2bc\cos A$ or $\cos A=\dfrac{b^2+c^2-a^2}{2bc}$

Area of a triangle $A=\frac{1}{2}ab\sin C$

Volume of a sphere $V=\frac{4}{3}\pi r^3$

Volume of a cone $V=\frac{1}{3}\pi r^2 h$

Volume of a pyramid $V=\frac{1}{3}Ah$

Standard deviation $s=\sqrt{\dfrac{\Sigma(x-\bar{x})^2}{n-1}}$

or $s=\sqrt{\dfrac{\Sigma x^2-\dfrac{(\Sigma x)^2}{n}}{n-1}}$, where n is the sample size.

Total marks — 60

Attempt ALL questions

1. A housing development is being built.

   The price of a house built in 2020 is £250 000.

   This price is expected to increase by 4% each year.

   Calculate the expected price of a house built in 2022. 3

Click here to view the worked solutions.

Video Lesson: APP 1·3b Bronze Outcome 2

2. Light travels at 3×10^{8} metres per second.

   A star is $4{\cdot}2\times10^{17}$ metres away from Earth.

   Calculate the number of seconds it takes for light from this star to reach Earth.

   Give your answer in scientific notation. 2

Click here to view the worked solutions.

Video Lesson: E+F 1·1b Gold Outcome 3

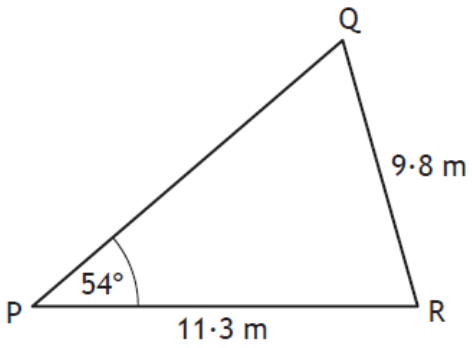
3. Factorise fully $3a^2 - 75$. 2

Click here to view the worked solutions.

Video Lesson: E+F 1·2b Gold Outcome 2

4. In triangle PQR

- PR = 11·3 metres
- QR = 9·8 metres
- angle QPR = 54°.

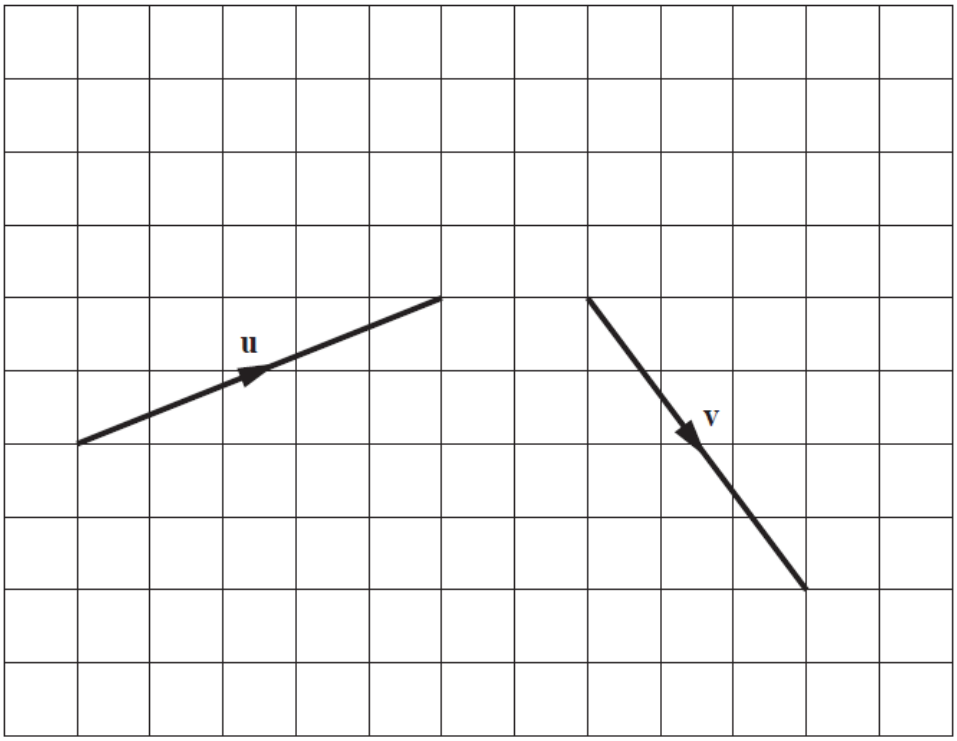


Calculate the size of acute angle PQR. 3

Click here to view the worked solutions.

Video Lesson: APP 1·1 Gold Outcome 2

5. The vectors $\mathbf{u}$ and $\mathbf{v}$ are shown in the diagram below.



Find the resultant vector $\mathbf{u} - \mathbf{v}$.

Express your answer in component form. 2

Click here to view the worked solutions.

Video Lesson: APP 1·4 Silver Outcome 1

6. A company operates a bus route from the city centre to the airport.

The number of passengers on six of its buses on a Monday was

32 27 34 29 31 33.

(a) Calculate the mean and standard deviation of the number of passengers. **4**

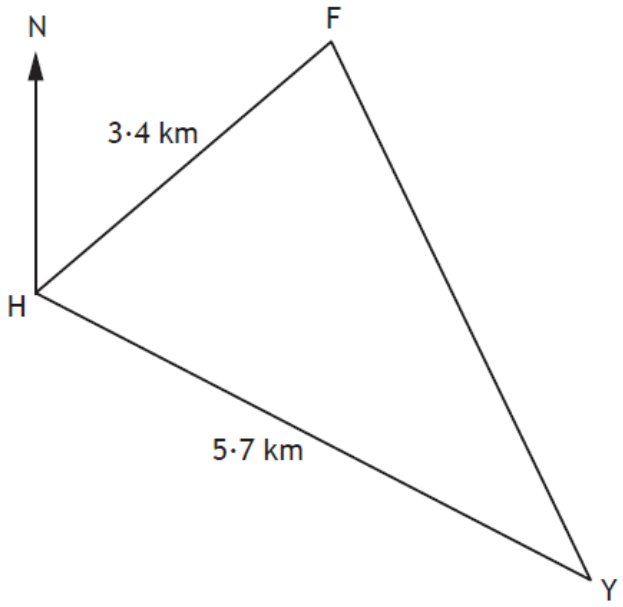
(b) The mean number of passengers the following Saturday was 28 and the standard deviation was 3·2.

Make two valid comments comparing the number of passengers on each bus on Monday and Saturday. **2**

Click here to view the worked solutions.

Video Lesson: APP 1·4 Bronze Outcome 2

7. A fishing boat and a yacht left a harbour at the point H.
The fishing boat travelled 3·4 kilometres on a bearing of 047° to the point F.
The yacht travelled 5·7 kilometres on a bearing of 115° to the point Y.



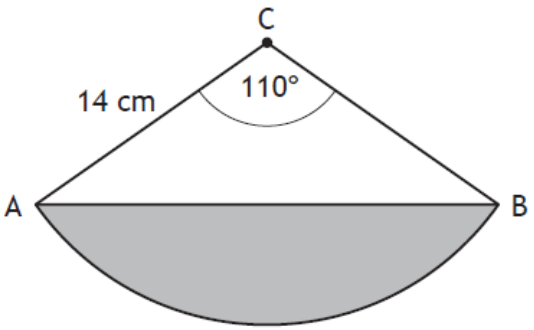
Calculate the distance between the fishing boat at F and the yacht at Y. 4

Click here to view the worked solutions.

Video Lesson: APP 1·1 Bronze Outcome 3

8. The diagram shows a sector of a circle, with centre C and radius 14 centimetres.

Angle ACB is 110°.



AB splits the sector into the shaded segment and triangle ABC.

Find the area of the shaded segment. 5

Click here to view the worked solutions.

Video Lesson: APP 1·1 Bronze Outcome 1 and E+F 1·4b Bronze Outcome 2

9. A straight line has equation $3x + 4y - 8 = 0$.

(a) Find the gradient of the line. 2

(b) State the coordinates of the point where the line crosses the y-axis. 1

Click here to view the worked solutions.

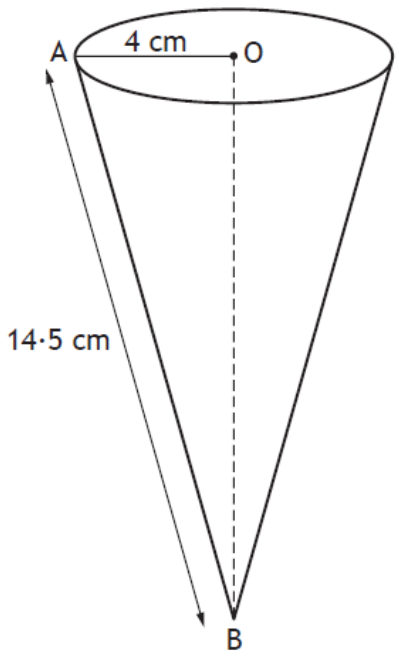
Video Lesson: REL 1·1a Gold Outcome 1

10. Change the subject of the formula $d = \sqrt{\frac{3h}{2}}$ to h. 3

Click here to view the worked solutions.

Video Lesson: REL 1·1e Silver Outcome 2

11. The base of an ice cream cone has centre O and radius 4 centimetres.
The length of AB is 14·5 centimetres.



Calculate the volume of the cone.
Give your answer correct to 2 significant figures. 5

Click here to view the worked solutions.

12. Express

$$\frac{6x}{y} \div \frac{2x^2}{y+5}, \quad x \neq 0,\ y \neq 0,\ y \neq -5$$

as a single fraction in its simplest form. 3

Click here to view the worked solutions.

Video Lesson: E+F 1·3 Gold Outcome 4

13. The two photographs shown are mathematically similar.

12 cm

width

The small photograph has an area of 80 square centimetres, and is 12 centimetres wide.

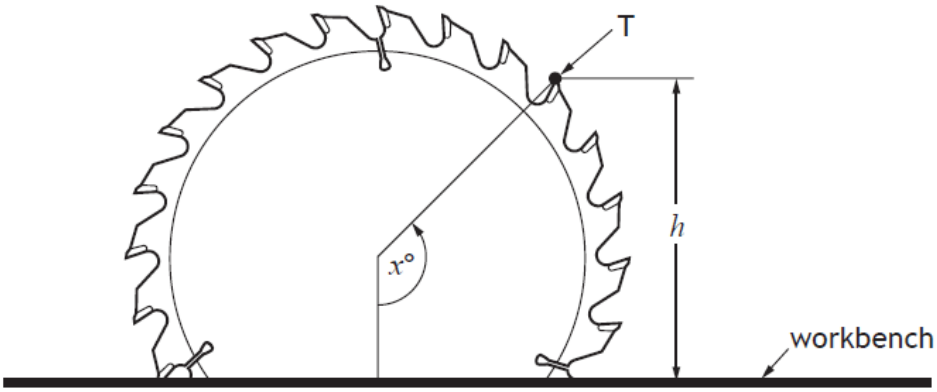
The large photograph has an area of 500 square centimetres.

Calculate the width of the large photograph. 3

Click here to view the worked solutions.

Video Lesson: REL 1·4c Gold Outcome 2

14. The diagram shows the part of the blade of a circular saw above a workbench.



As the blade rotates, the height, h millimetres, of point T above the workbench is given by

$$h = 57 - 85\cos x°$$

where x is the angle the blade has turned anti-clockwise from a starting position.

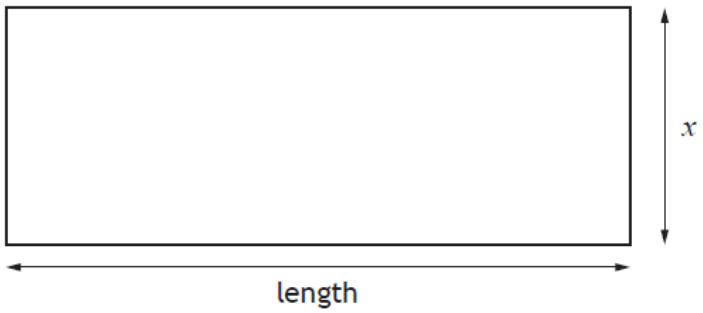
(a) Calculate the value of x when point T is first at a height of 115 millimetres above the workbench. 3

(b) Calculate the value of x when point T is next at this height. 1

Click here to view the worked solutions.

Video Lesson: REL 1·5b Silver Outcome 1

15. The diagram shows a rectangle with breadth x centimetres.



The length of the rectangle is 5 centimetres more than its breadth.

(a) Write down an expression for its length in terms of x. 1

The rectangle has an area of 20 square centimetres.

(b) Show that $x^2 + 5x - 20 = 0$. 2

(c) Calculate x, the breadth of the rectangle.
Give your answer correct to one decimal place. 4

Click here to view the worked solutions.

Video Lesson: REL 1·3a Silver Outcome 3

16. Expand and simplify

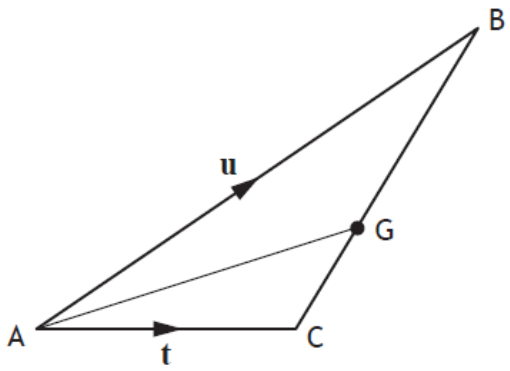
$$\cos x^\circ \left(\tan x^\circ + 1\right).$$ 2

Show your working.

Click here to view the worked solutions.

Video Lesson: REL 1·5b Silver Outcome 2

17. The triangle ABC is shown below



$\overrightarrow{AB} = \mathbf{u}$ and $\overrightarrow{AC} = \mathbf{t}$.

G is the point such that $CG = \frac{1}{3}CB$.

Express $\overrightarrow{AG}$ in terms of $\mathbf{u}$ and $\mathbf{t}$.

Give your answer in simplest form. 3

Click here to view the worked solutions.

Video Lesson: APP 1·4 Gold Outcome 2

[END OF QUESTION PAPER]