National 5 Mathematics

2021 Paper 1

Time allowed = 1 hr 15 mins Marks available = 50

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 ÷ 50 × 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 — 50

Attempt ALL questions

1. Calculate $|\mathbf{d}|$, the magnitude of vector $\mathbf{d} = \begin{pmatrix} 1 \\ -4 \\ 8 \end{pmatrix}$. 2

Click here to view the worked solutions.

Video Lesson: APP 1·2 Silver Outcome 4

2. Evaluate $5\frac{1}{2} - 1\frac{2}{7}$. 2

Click here to view the worked solutions.

Video Lesson: APP 1·3a Gold Outcome 1

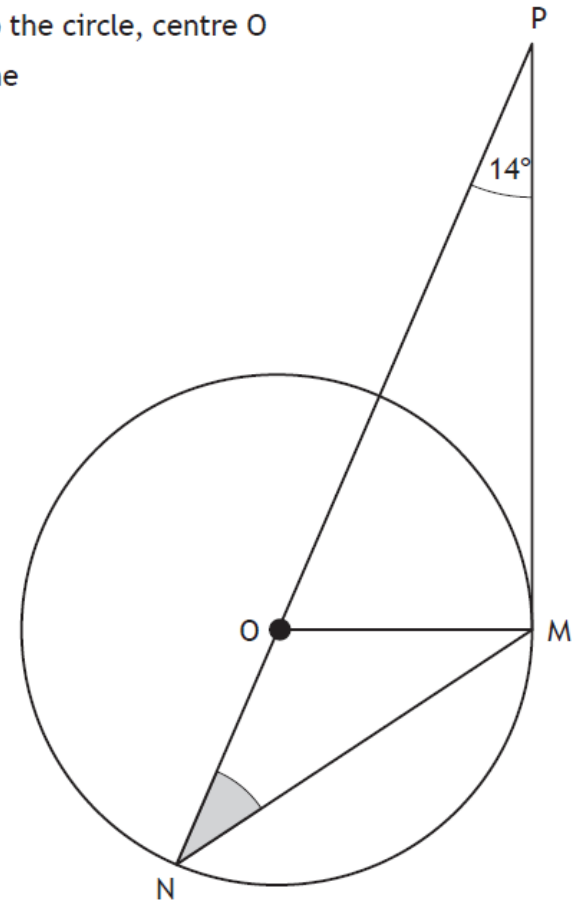
3. Expand and simplify $(6x-5)(x+3)+2x(4-x)$. 3

Click here to view the worked solutions.

Video Lesson: E+F 1·2a Gold Outcome 2

4. In the diagram shown below

- PM is a tangent to the circle, centre O
- PN is a straight line
- angle OPM is 14°.



Calculate the size of shaded angle ONM. 2

Click here to view the worked solutions.

Video Lesson: REL 1·4b Gold Outcome 1

5. The number of absentees at Applegrove High School was recorded each day over a four-week period.

The results are shown below.

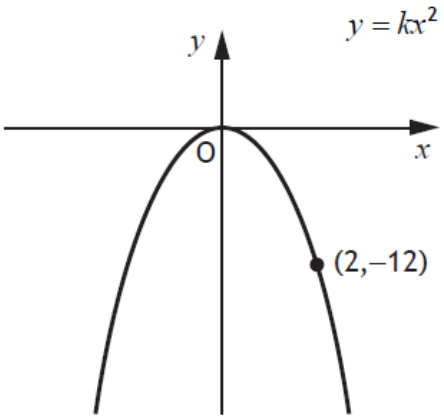
7	8	8	11	12	14	14	15	17	17
18	20	20	21	23	24	25	26	27	29

Find the semi-interquartile range of this data. 2

Click here to view the worked solutions.

Video Lesson: APP 1·4 Gold Outcome 1

6. The diagram below shows part of the graph of $y = kx^2$.



Find the value of k. 2

Click here to view the worked solutions.

Video Lesson: REL 1·2 Gold Outcome 1

7. Solve, algebraically, the system of equations

$$5c + 2d = 4$$
$$4c - 3d = 17$$

3

Click here to view the worked solutions.

Video Lesson: REL 1·1d Gold Outcome 1

8. Determine the nature of the roots of the function $f(x) = x^2 + 4x - 7$. 2

Click here to view the worked solutions.

Video Lesson: REL 1·3b Bronze Outcome 1

9. Express $\sqrt{50} + \sqrt{45} - \sqrt{2}$ in its simplest form. 3

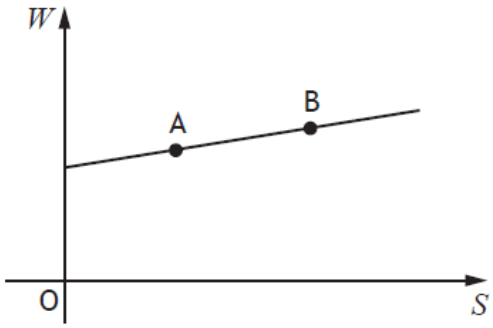
Click here to view the worked solutions.

Video Lesson: E+F 1·1a Silver Outcome 1

10. David works in a shop, and is paid weekly.

His wage is made up of a basic wage plus commission on his sales.

The graph shows his wage, W pounds, against his sales, S pounds.



Point A represents sales of £6000 and a wage of £450.

Point B represents sales of £7200 and a wage of £510.

(a) Find the equation of the line in terms of W and S.
Give the equation in its simplest form. 3

(b) Calculate David's wage in a week when his sales are £1000. 1

Click here to view the worked solutions.

Video Lesson: APP 1·4 Silver Outcome 3

11. Solve, algebraically, the inequation $1-(x+4)>2x$. 3

Click here to view the worked solutions.

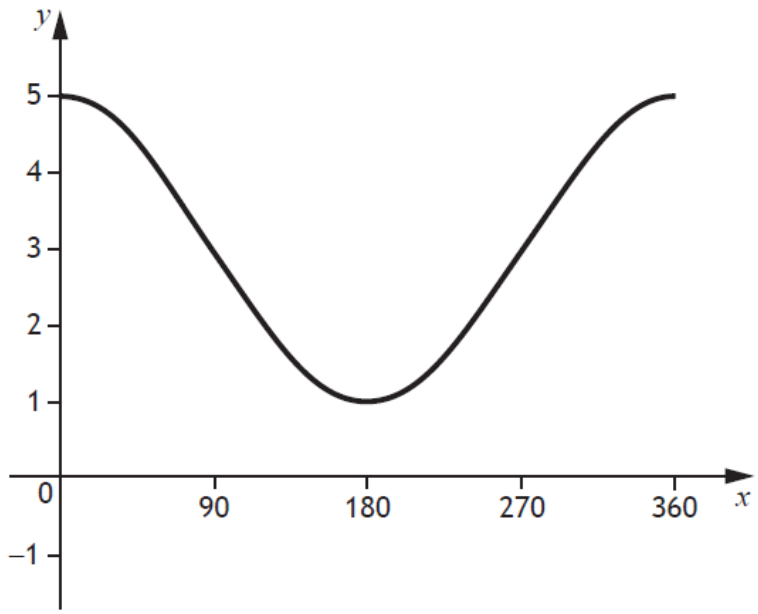
Video Lesson: REL 1·1c Silver Outcome 2

12. A band sold 2400 tickets for their gig in Edinburgh.
This was 75% of the number of tickets sold for their gig in Glasgow.
Calculate the number of tickets sold for their gig in Glasgow. 3

Click here to view the worked solutions.

Video Lesson: APP 1·3b Bronze Outcome 1

13. The graph of $y = a\cos x° + b$, $0 \leq x \leq 360$, is shown.

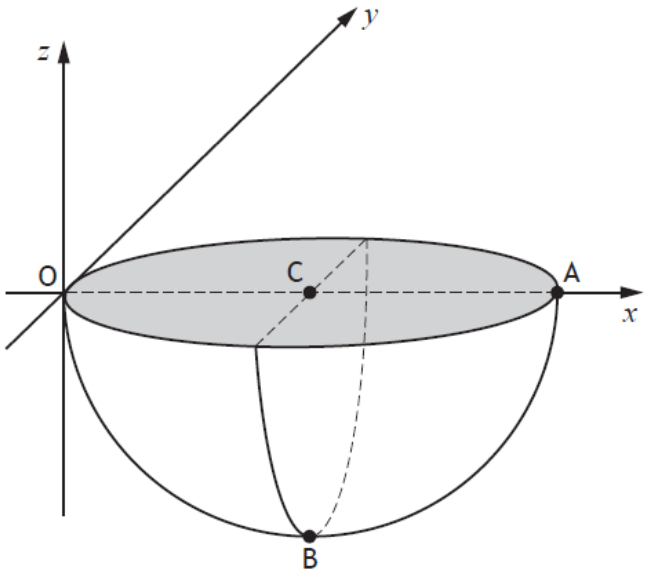


State the values of a and b. 2

Click here to view the worked solutions.

Video Lesson: REL 1·5a Gold Outcome 1

14. The diagram shows a hemisphere relative to the coordinate axes.



- A is the point (6, 0, 0)
- C is the midpoint of diameter OA
- B is vertically below C

(a) State the coordinates of B. 1

(b) Calculate the volume of the hemisphere.
Give your answer in its simplest form in terms of π. 2

Click here to view the worked solutions.

Video Lesson: APP 1·2 Silver Outcome 2 and E+F 1·4c Silver Outcome 3

15. Evaluate $16^{\frac{3}{2}}$. 2

Click here to view the worked solutions.

Video Lesson: E+F 1·1b Gold Outcome 2

16. The function $f(x)$ is defined by $f(x) = 4\sin 3x°$.

Evaluate $f(90)$. 2

Click here to view the worked solutions.

Video Lesson: REL 1·5a Gold Outcome 3

17. Sketch the graph of $y = 2(x-1)^2 + 4$.

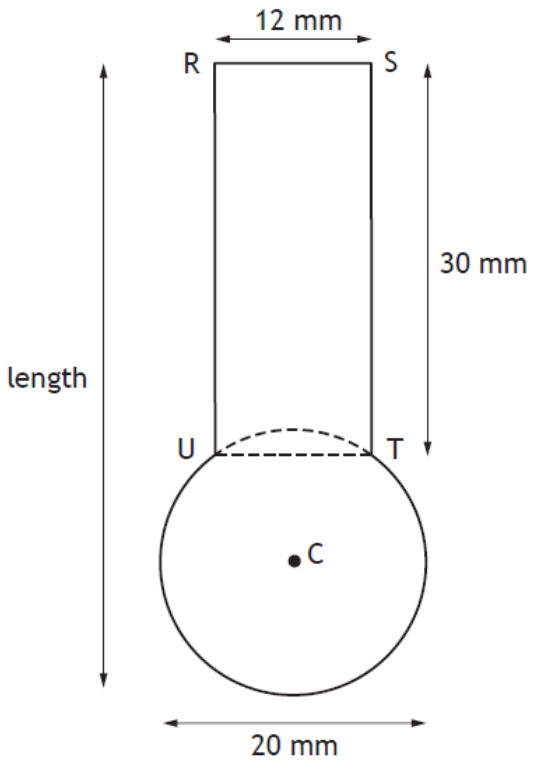
On your sketch, show clearly the coordinates of the turning point and the point of intersection with the y-axis. 3

Click here to view the worked solutions.

Video Lesson: REL 1·2 Bronze Outcome 1

18. The diagram below shows a design for a memory stick.

The design consists of a rectangle, RSTU and part of a circle, centre C.



memory stick

- RS = UT = 12 millimetres
- RU = ST = 30 millimetres
- The diameter of the circle is 20 millimetres
- UT is a chord of the circle

Calculate the length of the memory stick. **4**

Click here to view the worked solutions.

Video Lesson: E+F 1·1b Gold Outcome 2

19. Solve the equation by factorising

$$6x^2 + 13x - 5 = 0$$ 3

Click here to view the worked solutions.

Video Lesson: E+F 1·1b Gold Outcome 2

[END OF QUESTION PAPER]