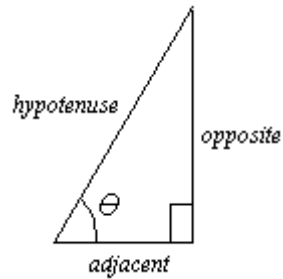


LIST OF FORMULAE

Roots of quadratic equations If $ax^2 + bx + c = 0$

$$\text{then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

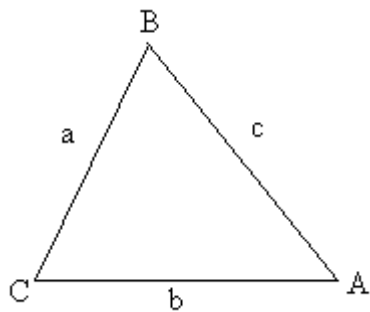


Trigonometric ratios

$$\sin\theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos\theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan\theta = \frac{\text{opposite side}}{\text{adjacent side}}$$



Sine rule

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Cosine rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Area of triangle

$$\text{Area of } \Delta ABC = \frac{1}{2} ab \sin C$$

SECTION A

Write the letter that matches your response to each question.

1. Solve $\frac{x-1}{3} + 2 = \frac{x+5}{4}$

- A: 8 B: 3 C: -5 D: -30

2. Which of the following correctly expresses t as the subject of the formula

$$\frac{p}{2} = \sqrt{\frac{t+r}{g}} \quad ?$$

A: $t = \frac{(gp)^2}{2} - r$ B: $t = \left(\frac{gp}{2} - r\right)^2$

C: $t = \frac{(gp)^2}{4} - r$ D: $t = \frac{gp^2}{4} - r$

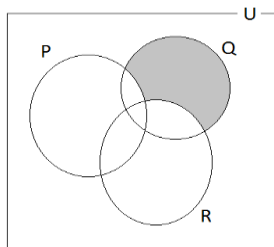
3. Make t the subject of the formula

$$ct + ys = ft + gs.$$

A: $t = \frac{gs-ys}{f-c}$ B: $t = \frac{ft+gs-ys}{c}$

C: $t = \frac{gs-ys}{c-f}$ D: $t = \frac{ft+gs}{cys}$

4.



The shaded area in the Venn diagram above represents

- A: $(P \cup Q)'$ B: $(Q \cup R)'$
 C: $(P \cap Q)' \cup R$ D: $(P \cup R)' \cap Q$

5. $5(2x - y) - 2(3y - 5x) =$

- A: $-11y$ B: $2x - 6y$
 C: $5x - 7y$ D: $20x - 11y$

6. If $x^2 + y^2 - xy$ is equivalent to

- A: $(x - y)^2 - xy$ B: $(x + y)^2 - xy$
 C: $(x - y)^2 + xy$ D: $(x + y)^2 + 2xy$

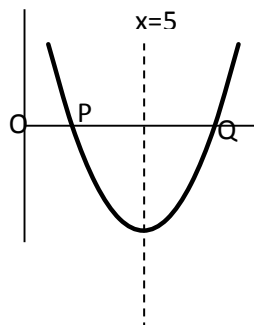
7. The number that must be added to $x^2 + 6x + 8$ to make it a perfect square is

- A: 1 B: 2 C: 6 D: 8

8. If $f: x \rightarrow 3x^2 - 2x + 1$, then $f(-2) = ?$

- A: -7 B: 9 C: 14 D: 17

9. The graph below shows part of a parabola with the equation of the form $y = (x + a)^2 + b$



The equation of the axis of symmetry of the parabola is $x = 5$.

P is the point (2, 0). State the coordinates of Q.

- A: (7, 0) B: (0, 7) C: (8, 0) D: (10, 0)

10. Under reflection in the line $x = 6$, the point $Y(3, 2)$ is mapped on to a point Y' .

What are the coordinates of Y' ?

- A: (-3, -2) B: (3, -2) C: (9, 2) D: (9, -2)

11. When rotated through 90° about the origin in an anti-clockwise direction, the image of the point (1, 2) is

- A: (2, 1) B: (2, -1) C: (-1, -2) D: (-2, 1)

12. The position vectors of the points P and Q are $\begin{pmatrix} 5 \\ -3 \end{pmatrix}$ and $\begin{pmatrix} 11 \\ 5 \end{pmatrix}$ respectively.

The length of the vector \overrightarrow{PQ} is

- A: 10 B: 6.32 C: 16.2 D: 6.24

13. The acute angle that vector $\mathbf{u} = \begin{pmatrix} 8 \\ 6 \end{pmatrix}$ makes with the x -axis is

- A: $\tan^{-1} \frac{4}{3}$ B: $\tan^{-1} \frac{3}{4}$ C: $\cos^{-1} \frac{3}{4}$ D: $\cos^{-1} \frac{4}{3}$

14. Given that $\mathbf{p} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} x \\ 12 \end{pmatrix}$, the value of x for which \mathbf{p} is parallel to \mathbf{q} is

- A: 8 B: 16 C: -16 D: -8

15. If the matrix $A = \begin{pmatrix} 2 & -3 \\ 6 & x \end{pmatrix}$ is singular then x is

- A: 4.5 B: 9 C: -4.5 D: -9

SECTION B

16. In a class, the students all study at least one language from French, Spanish and Portuguese.

No student studies all three languages.

All of the students who study Portuguese study French.

4 students study both French and Portuguese.

12 students study Spanish but not French.

9 students study French but not Spanish.

A total of 16 students study French.

(i) Draw a Venn diagram to show all of the above information. [4]

(ii) Find the total number of students in this class. [1]

17. Factorise completely

(i) $6m + 4n - 9km - 6kn$ [2]

(ii) $2x^2 - 18$ [2]

(ii) $2x^2 - 9x - 5$ [2]

18. (i) Express $2x^2 - 4x + 1$ in the form $a(x + h)^2 + k$ and hence state the coordinates of the minimum point, A, on the curve $y = 2x^2 - 4x + 1$. [4]

(ii) Solve the simultaneous equations

$$x - y + 4 = 0$$

$$y = 2x^2 - 4x + 1 \quad [4]$$

19. The functions f and g are such that

$$f(x) = 6x + 1 \quad \text{and} \quad g(x) = \frac{4}{x} - 3$$

(i) Evaluate $fg(2)$. [2]

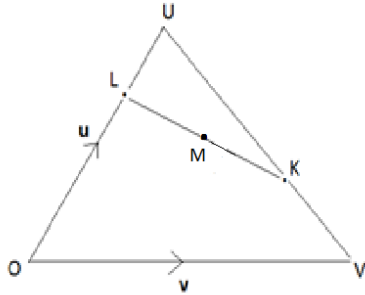
(ii) Write expressions in x for

(a) $g^{-1}x$ [2]

(b) $ff(x)$ [2]

20. A plane leaves A and travels on a bearing of 044° to B 53 km away. It then departs to C which is 97 km away on a bearing of 152° from B.
- (a) Draw a well labelled diagram to represent this information. [4]
- (b) Calculate to the nearest km the distance from C to A. [4]
- (c) Determine the bearing of A from C. [4]

21.



In the diagram, $\overrightarrow{OU} = \mathbf{u}$ and $\overrightarrow{OV} = \mathbf{v}$.

K is on UV so that $\overrightarrow{UK} = \frac{2}{3}\overrightarrow{UV}$ and L is on OU so that $\overrightarrow{OL} = \frac{3}{4}\overrightarrow{OU}$.

M is the midpoint of KL.

Find the following in terms of \mathbf{u} and \mathbf{v} , giving your answers in their simplest form.

- (i) \overrightarrow{LK} [4]
- (ii) \overrightarrow{OM} [4]
22. Given that $A = \begin{pmatrix} 4 & -1 \\ 4 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 0 \\ -3 & 4 \end{pmatrix}$

Find

- (a) $2A - B$ [2]
- (b) AB [2]
- (c) A^{-1} [2]

23. Answer this question on the sheet provided.

- (a) Describe fully the **single** transformation which maps shape P onto shape Q . [3]
- (b) On the grid provided
- (i) reflect shape P in the y axis and label the image X , [2]
- (ii) translate shape P by $\begin{pmatrix} -6 \\ -4 \end{pmatrix}$ and label the image Y , [2]
- (iii) enlarge shape P by scale factor 2, with centre $(0, 0)$ and label the image Z . [2]