

Time: 2 hours 15 minutes

List of Formulae

Circumference

$$C = 2\pi r \text{ where } r \text{ is the radius of the circle.}$$

Arc length

$$S = \frac{\theta}{360} \times 2\pi r \text{ where } \theta \text{ is the angle subtended by the arc, measured in degrees.}$$

Area of a circle

$$A = \pi r^2 \text{ where } r \text{ is the radius of the circle.}$$

Area of a sector

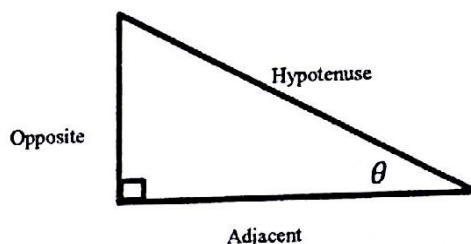
$$A = \frac{\theta}{360} \times \pi r^2 \text{ where } \theta \text{ is the angle of the sector, measured in degrees.}$$

Trigonometric ratios

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

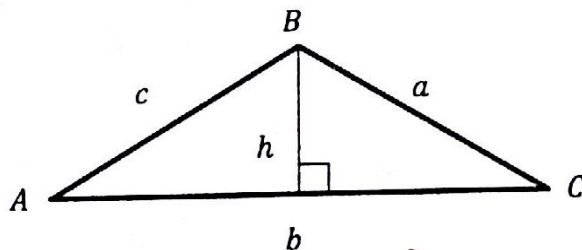
$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

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



Area of a triangle

Area of $\Delta = \frac{1}{2} b \times h$ where b is the length of the base and h is the perpendicular height



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

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\text{where } s = \frac{a+b+c}{2}$$

Sine rule

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

Cosine rule

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

Roots of quadratic equations

$$\text{If } ax^2 + bx + c = 0,$$

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

Section A - Multiple Choice

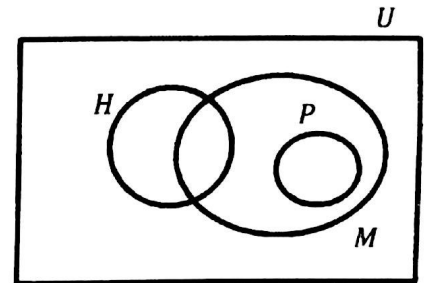
On the foolscap provided, write down the letter that corresponds to the correct answer.

DO NOT write on the question paper.

1. The Venn diagram below shows the set of students studying mathematics (M), the set of students studying history (H) and the set of students studying physics (P).

Which of the following deductions can be made?

- i) No student studies both physics and history.
- ii) Some students study both mathematics and history.
- iii) Some students study both physics and chemistry.



- A) none
- B) i and ii
- C) i
- D) i, ii and iii

2. $\frac{p^2q^3}{p^3q^2} =$

- A) pq^2
- B) $p^{-1}q^2$
- C) pq^{-1}
- D) $p^{-1}q$

3. If $D = \frac{\sqrt{2a}}{b}$ then $a =$

- A) $\frac{Db}{2}$
- B) $\frac{D^2b^2}{4}$
- C) $\frac{Db}{4}$
- D) $\frac{D^2b^2}{2}$

4. The expression $(3x - 2)(x + 1) \equiv$

- A) $3x^2 - x - 2$
- B) $3x^2 + x - 2$
- C) $3x^2 - x + 2$
- D) $3x^2 + x + 2$

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

- A) $\frac{5x+3}{4}$
- B) $\frac{7x+3}{4}$
- C) $\frac{5x+1}{4}$
- D) $\frac{7x+1}{4}$

6. $\frac{3}{3+6u} =$

- A) $\frac{1}{2u}$
- B) $\frac{1}{6u}$
- C) $\frac{1}{1+2u}$
- D) $\frac{1}{1+6u}$

7. $\frac{x^2 - 2x - 15}{x - 5} =$

A) $x + 3$

B) $x - 5$

C) $2x + 3$

D) none of these

8. $f(x) = 3x^2 + 4x - 5$, then $f(-2) =$

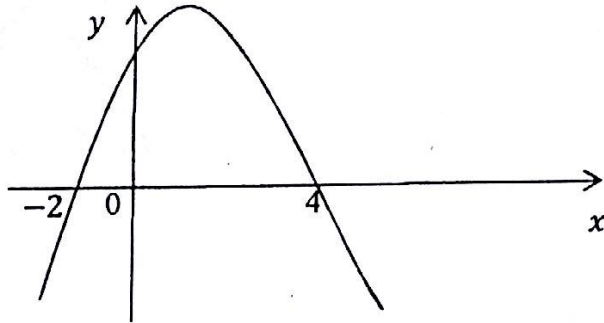
A) -49

B) -1

C) 9

D) 23

9.



The equation representing the graph to the left is

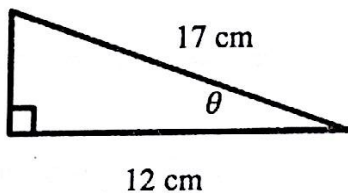
A) $y = 8 - 2x + x^2$

B) $y = 8 + 2x - x^2$

C) $y = -8 - 2x + x^2$

D) $y = 8 - 2x - x^2$

10. In the diagram below, which of the following is true?



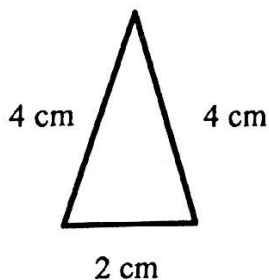
A) $\sin\theta = \frac{12}{17}$

B) $\cos\theta = \frac{12}{17}$

C) $\sin\theta = \frac{17}{12}$

D) $\tan\theta = \frac{17}{12}$

11. The area of the triangle below is



A) $\sqrt{5} \text{ cm}^2$

B) $\sqrt{15} \text{ cm}^2$

C) $2\sqrt{5} \text{ cm}^2$

D) 4 cm^2

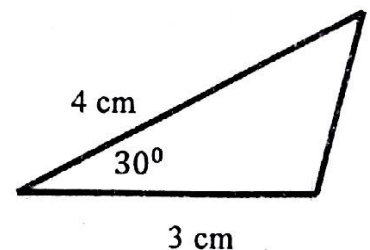
12. The area of the triangle to the right is

A) 3 cm^2

B) $3\sqrt{3} \text{ cm}^2$

C) 6 cm^2

D) $6\sqrt{3} \text{ cm}^2$



13. If $M = \begin{pmatrix} 1 & 1 \\ 1 & 2 \end{pmatrix}$, then $M^{-1} =$

A) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

B) $\begin{pmatrix} -1 & 1 \\ 1 & -2 \end{pmatrix}$

C) $\begin{pmatrix} 2 & -1 \\ -1 & 1 \end{pmatrix}$

D) $\begin{pmatrix} 1 & -1 \\ -1 & 2 \end{pmatrix}$

14. $M = \begin{pmatrix} 2 & 4 \\ 3 & x \end{pmatrix}$. If M is singular then $x =$

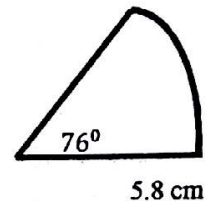
- A) -12
B) -6

- C) 6
D) 12

15. The area of this sector of a circle is

- A) 7.1 cm^2
B) 21.3 cm^2

- C) 17.6 cm^2
D) 22.3 cm^2



End of Section A

Section B

Read the following instructions carefully.

1. Write your name and your teacher's name clearly on each sheet of paper used.
2. Answer all questions.
3. Number your answers carefully and do NOT attempt questions beside one another.
4. All working must be clearly shown. It should be done on the SAME sheet of paper as the answer to which it relates. Omission of essential working will result in the loss of marks.
5. If the degree of accuracy is not specified in the question, and if the answer is not exact, the answer should be given to three significant figures.
6. Formulae are provided. Electronic calculators may be used.
7. The number of marks available is shown in the brackets, [], at the end of each question.

1. Solve the following quadratic equation

$$2x^2 - 11x + 12 = 0 \quad [4]$$

2. a) Write the quadratic expression $3x^2 - 18x + 7$ in the form $a(x + b)^2 + c$. [3]

b) Hence, or otherwise, solve the equation $3x^2 - 18x + 7 = 0$, giving answers correct to 2 decimal places. [3]

3. Solve the following simultaneous equations

$$4x^2 - xy = 2$$

$$y = 3x - 1$$

[6]

4. Change the subject of each formula to the letter shown in brackets:

a) $A = \pi r^2 + 2\pi r h$ (h)

[2]

b) $a + 2b = c - 3a(b - c)$ (c)

[3]

c) $V = \pi r^2 h$ (r)

[2]

d) $L = \sqrt{a^2 - b^2}$ (b)

[3]

5. The functions f and g are defined as follows

$$f(x) = \frac{x+3}{2x-1} \text{ and } g(x) = x+4$$

a) Calculate

i) $g(-1)$

[1]

ii) $f(5)$

[1]

b) Write expressions for

i) $g^{-1}(x)$

[2]

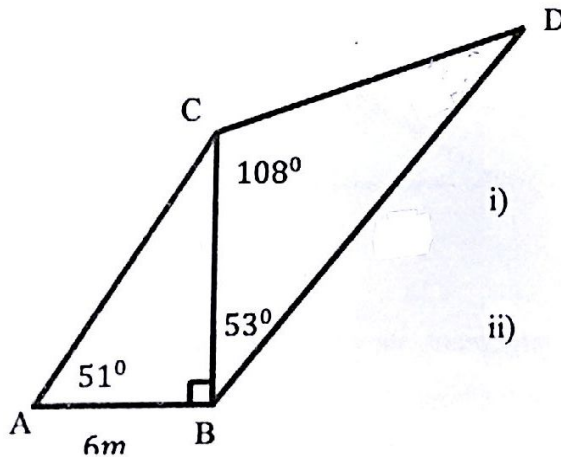
ii) $fg(x)$

[2]

iii) $f^{-1}(x)$

[3]

6.



i) If $AB = 6m$, find the length of BC .

[2]

ii) Calculate the length of BD .

[4]

7. i) Calculate the values of a and b such that $\begin{pmatrix} a & -4 \\ 1 & b \end{pmatrix} \begin{pmatrix} 2 & -4 \\ 1 & -3 \end{pmatrix} = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$.

[3]

ii) Hence, or otherwise, write down the inverse of $\begin{pmatrix} 2 & -4 \\ 1 & -3 \end{pmatrix}$.

[2]

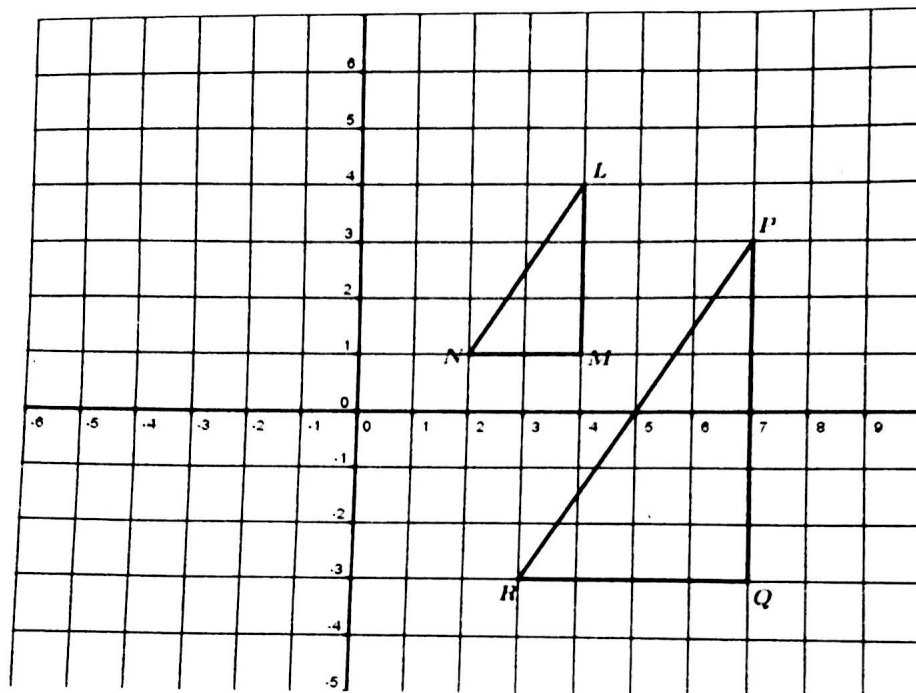
iii) Use the inverse of $\begin{pmatrix} 2 & -4 \\ 1 & -3 \end{pmatrix}$ to solve for x and y in the matrix equation

$$\begin{pmatrix} 2 & -4 \\ 1 & -3 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 12 \\ 7 \end{pmatrix}$$

[3]

8. An answer sheet is provided for this question.

The graph below shows triangle LMN and its image PQR after an enlargement.



On the sheet provided

- Locate the centre of enlargement, showing your method clearly. [2]
- State the scale factor and the coordinates of the centre of the enlargement. [2]
- Determine the value of $\frac{\text{Area of } PQR}{\text{Area of } LMN}$. [2]
- Draw and label triangle ABC with coordinates $(-4, 4)$, $(-1, 4)$ and $(-1, 2)$ respectively. [2]
- Describe fully the single transformation which maps triangle LMN on to triangle ABC . [3]

End of Exam