

HARRISON COLLEGE

FOURTH FORM PROMOTION EXAMINATION PAPER May 2012

Time: 2 hours

INSTRUCTIONS

This question paper consists of **THREE** printed pages.

Answer **ALL** questions.

Write your name clearly on each sheet of paper used.

Number your answers carefully and do **NOT** do questions beside one another.

All working **MUST** be clearly shown. It should be done on the same sheet as the rest of the answer.

Omissions of essential working will result in the loss of marks.

If the degree of accuracy is not specified in the question, and if the answer is not exact, the answer should be given to 2 decimal places.

Formulae are provided. Mathematical tables or electronic calculators may be used to evaluate explicit numerical expressions.

LIST OF FORMULAE

Volume of a prism $V = Ah$ where A is the area of a cross-section and h is the perpendicular length.

Volume of a right pyramid $V = \frac{1}{3}Ah$ where A is the area of the base and h is the perpendicular height.

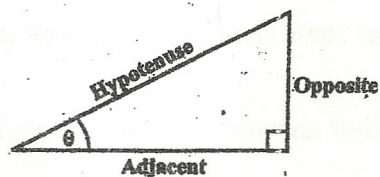
Circumference $C = 2\pi r$ where r is the radius of the circle.

Area of a circle $A = \pi r^2$ where r is the radius of the circle.

Area of trapezium $A = \frac{1}{2}(a+b)h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.

Roots of quadratic equations If $ax^2 + bx + c = 0$,
then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

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



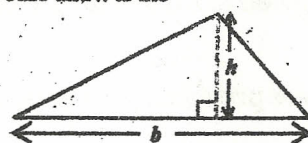
$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$

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

Area of triangle

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

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

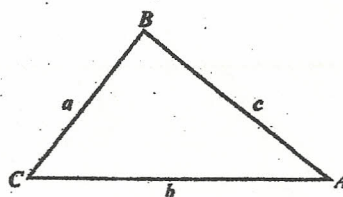


Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$

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

Sine rule

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



Cosine rule

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

GO ON TO THE NEXT PAGE

1. (a) If $a = 2$, $b = -3$ and $c = 4$, evaluate

(i) $ab - bc$

[3]

(ii) $b(a - c)^2$

[3]

(b) Solve for x

(i) $\frac{x}{2} + \frac{x}{3} = 5$

[2]

(ii) $3x^2 - 7x - 6 = 0$

[3]

(c) Factorise completely

(i) $xy^3 + x^2y$

[2]

(ii) $9 - 25m^2$

[2]

(iii) $2mh - 2nh - 3mk + 3nk$

[3]

Total 18 marks

2. (a) The universal set $U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

$A = \{0, 1, 2, 7, 9\}$

$B = \{3, 4, 5\}$

$C = \{2\}$

(i) Draw a Venn diagram to represent the above information.

[5]

(ii) List, using set notation, the members of $A' \cap B'$.

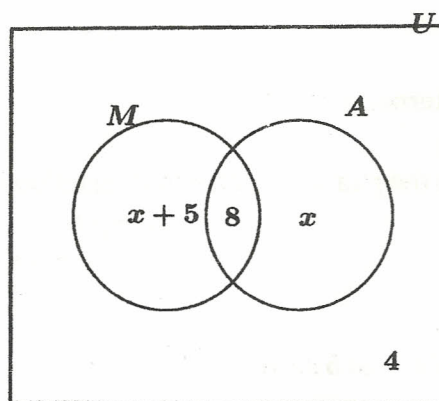
[1]

(b) The Venn diagram below shows the number of students who study Music and Art in a class of 35 students.

$U = \{\text{students in a class}\}$

$M = \{\text{students who study Music}\}$

$A = \{\text{students who study Art}\}$



(i) How many students study neither Art nor Music?

[1]

(ii) Calculate the value of x .

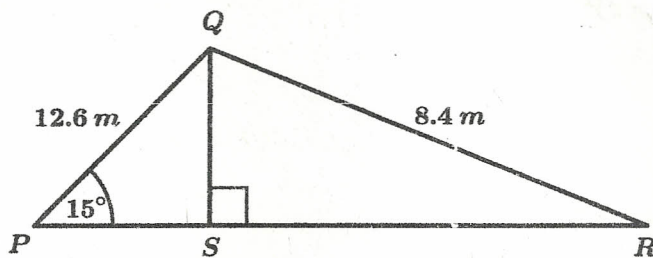
[3]

(iii) Hence, state the number of students who study Music only.

[1]

Total 11 marks

3. (a) The diagram below not drawn to scale shows ΔPQR which represents the cross section of a roof. QS is perpendicular to PSR . $PQ = 12.6$ m, $QR = 8.4$ m and $\angle P = 15^\circ$.



Calculate correct to 3 significant figures

- (i) the length of QS , [3]
 (ii) $\angle RQS$ [3]
 (iii) the area of ΔPQR [3]

- (b) Points O , P and Q are on the same horizontal plane. P is 15 m away from O on a bearing of 040° from O . Q is on a bearing of 120° from O and $OQ = 17$ m

- (i) Sketch a diagram to show the positions of O , P and Q , clearly indicating the North positions. [4]
 (ii) Calculate the distance PQ . [2]

(iii) Calculate the bearing of Q from P [4] Total 15 marks

4. The position vectors of the points P , Q and R , relative to an origin O , are $\vec{OP} = \begin{pmatrix} 7 \\ 9 \end{pmatrix}$, $\vec{OQ} = \begin{pmatrix} 4 \\ 6 \end{pmatrix}$ and $\vec{OR} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$.

Express in the form $\begin{pmatrix} a \\ b \end{pmatrix}$ the vectors \vec{PQ} and \vec{RQ} . [5]

Total 5 marks

5. (a) $A = \begin{pmatrix} 2 & -1 \\ 3 & -4 \end{pmatrix}$

- (i) Find the determinant of A . [1]
 (ii) Find A^{-1} . [2]
 (iii) Hence solve the pair of simultaneous equations

$$\begin{aligned} 2x - y &= -1 \\ 3x - 4y &= -4 \end{aligned}$$

[4]

- (b) Calculate the value of a and b such that

$$\begin{pmatrix} 2 & 1 \\ a & 4 \end{pmatrix} \begin{pmatrix} 5 \\ b \end{pmatrix} = \begin{pmatrix} 8 \\ 7 \end{pmatrix}$$

[5]

Total 12 marks

6. (a) The function g and h are defined as

$$g(x) = \frac{3x-1}{x+2} \quad \text{and} \quad h(x) = 7x+1$$

Find

- (i) $g(3)$ [2]
- (ii) $g^{-1}(x)$ [4]
- (iii) x such that $h(x) = 3$ [2]
- (b) (i) Express $f(x) = 2x^2 + 4x - 3$ in the form $f(x) = a(x+p)^2 + q$ by the method of completing the square. [4]
- (ii) Hence state the coordinates of the minimum point of $f(x)$. [2]

Total 14 marks

Total 75 marks

END OF EXAMINATION