HARRISON COLLEGE

END OF YEAR EXAMINATION

2022

FOURTH FORM PROMOTION EXAMINATION

***DURATION:* 1 HOUR AND 30 MINS**

INSTRUCTION

INSTRUCTIONS TO CANDIDATES

1) This paper consists of **TWO SECTIONS: A AND B**.
2) **SECTION A** has seven multiple choice questions and **SECTION B** has four questions.
3) Answer **ALL** questions in both sections.
4) This Examination Paper consists of **NINE** printed pages and ONE EXTRA page for **additional working**.
5) Calculators are **ALLOWED**.
6) If a numerical answer cannot be given **exactly**, and the accuracy required is not specified in the question, then in the case of an angle it must be given correct to **one (1)** decimal place, in other cases it **must** be given correct to **three (3) significant figures**.
7) The maximum mark for this Examination is **65**.
8) Write your **NAME** and **FORM** below.

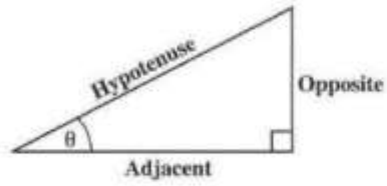
NAME OF STUDENT: ____

FORM: __________

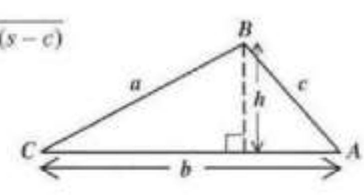
DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

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 cylinder	$V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.
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.
Arc length	$S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.
Area of a circle	$A = \pi r^2$ where r is the radius of the circle.
Area of a sector	$A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.
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	$a^2 = b^2 + c^2 - 2bc\cos A$



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SECTION A

Please shade the letter that corresponds with your answer.

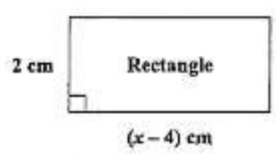
1. $(x + 2)(3x + 4) =$

(A) $3x^2 - 10x + 8$
(B) $3x^2 + 10x + 8$
(C) $3x^2 - 2x - 8$
(D) $3x^2 - 6x - 8$

2. If $\frac{p}{5} = 20$, then $p =$

(A) $20 - 5$
(B) 20×5
(C) $20 \div 5$
(D) $20 + 5$

3. Item 3 refers to the following diagram



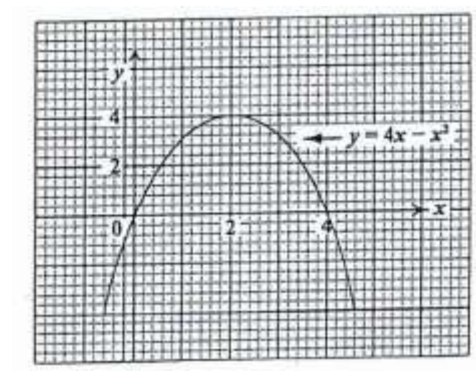
The area of the rectangle in, cm^2, is x^2. The equation that may be used to find the value is

(A) $x^2 = 2(x - 4)$
(B) $x^2 = (x - 2)(x - 4)$
(C) $x^2 = 2(x - 4)(x - 2)$
(D) $x^2 = (x - 4)(x + 2)$

4. If A = $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$, $B = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and $C = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$, then $AB + 2C$ *equals*

(A) $\begin{pmatrix} 0 \\ 3 \end{pmatrix}$
(B) $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$
(C) $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$
(D) $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$

Items 5 and 6 refers to the following graph of a quadratic function



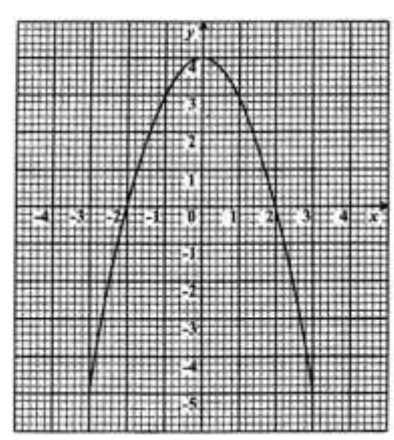
5. The maximum point of $y = 4x - x^2$ is

(A) (0,0)
(B) (2,4)
(C) (0,4)
(D) (4,2)

6. The values of x at the points where $y = 4x - x^2$ intersects $y = 0$ are

(A) $x = 0$ *and* $x = 4$
(B) $x = 0$ *and* $x = 2$
(C) $x = 2$ *and* $x = 4$
(D) $x = 0$ *and* $x = -4$

7.



From the graph, the values of x when $y = -1$ are

(A) 1 *and* -1
(B) 2.2 *and* -2.2
(C) 2.5 *and* -2.5
(D) 2.8 *and* -2.8

SECTION B

Question 1

(a) Factorize, completely, each of the following:

(i) $8r^3 + r - 64r^2 - 8$ [3]

(ii) $2x^2 - 32$ [2]

(iii) $2x^2 + 5x - 12$ [3]

(b) Solve each of the following equations

(i) $2x^2 + 7x + 8 = 12$ [6]

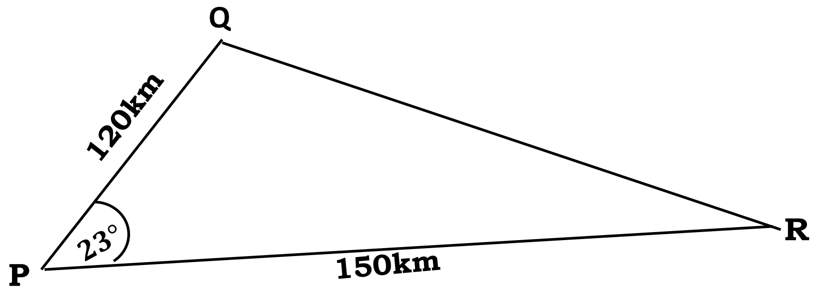
(ii) $4 + 6x = 9x^2$, give your answer to **2 decimal places.** [4]

(c) Solve the simultaneous equation [7]

$$x^2 - 2y = 11$$
$$3x + 2y = 7$$

Question 2

The diagram, not drawn to scale, shows the positions of three points, P, Q and R.

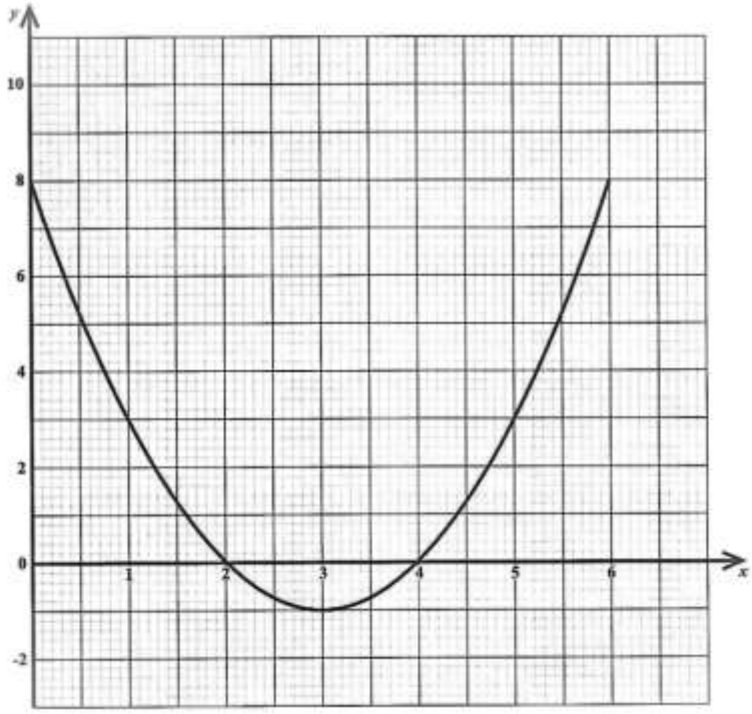


(i) Find the distance of Q from R, stating your answer correct to 2 decimal places. [4]

(ii) Find the area of ▲triangle PQR. [3]

Question 3

The diagram below shows the graph of the function $f(x) = x^2 - 6x + 8$ for the values of x from 0 to 6.



(i) Use the graph to solve the equation $x^2 - 6x + 8 = 0$. [2]

(ii) Write down the coordinates of the minimum point in the form (x, y). [1]

(iii) Write $x^2 - 6x + 8$ in the form $a(x + h)^2 + k$ where a, h *and* k are constants. [3]

(iv) State the equation of the axis of symmetry. [1]

Question 4

(a) The position vectors of A, B and C relative to the origin O, are

$$\overrightarrow{OA} = \begin{pmatrix} 2 \\ -2 \end{pmatrix}; \ \overrightarrow{OB} = \begin{pmatrix} 6 \\ 1 \end{pmatrix} \ and \ \overrightarrow{OC} = \begin{pmatrix} 10 \\ 4 \end{pmatrix} \ respectively$$

(i) Express in the form $\begin{pmatrix} x \\ y \end{pmatrix}$ the vectors

- $\overrightarrow{AB}$ [2]

- $\overrightarrow{AC}$ [2]

(ii) Hence, determine whether A, B and C are collinear, **giving the reason for your answer.** [2]

(b) Determine the value of x for which the matrix $\begin{pmatrix} 3 & x \\ 2 & 4 \end{pmatrix}$ is singular.

[3]

(c) M and T are 2×2 matrices such that $M = \begin{pmatrix} 4 & 1 \\ 3 & 2 \end{pmatrix}$ and $T = \begin{pmatrix} 1 & 5 \\ 2 & 1 \end{pmatrix}$

(i) Determine MT [2]

(ii) Given that $TM = \begin{pmatrix} 19 & 11 \\ 11 & 4 \end{pmatrix}$, determine whether matrix multiplication is commutative. [1]

(iii) Determine $M^{-1}, \textit{the inverse of } M$ [3]

(iv) Hence, calculate the values of x and y for which $\begin{pmatrix} 4 & 1 \\ 3 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$. [4]

END OF EXAMINATION