

HARRISON COLLEGE
FOURTH FORM MATHEMATICS
END OF YEAR ASSESSMENT 2021

DURATION: 1 hour

GENERAL INSTRUCTIONS TO CANDIDATES:

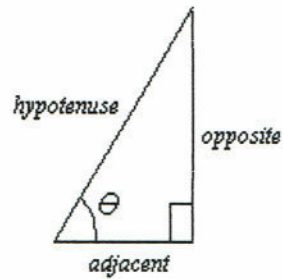
- 1) This question paper consists of NINE printed pages including the cover page.
- 2) Write your name clearly on **EACH** sheet of paper used.
- 3) All sixteen questions are to be attempted.
 - (a) For your responses to questions in section A, circle the letter that matches your response to each question.
 - (b) For your responses to questions 12 - 16 in Section B, write your responses carefully in the spaces provided as they appear on the question paper.
- 4) Calculators are allowed.
- 5) 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.
- 6) The maximum mark for this examination is **50**.

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

LIST OF FORMULAE

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

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

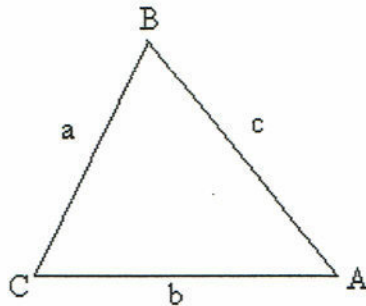


Trigonometric ratios

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

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

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



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:

Circle the letter that matches your response to each question.

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?

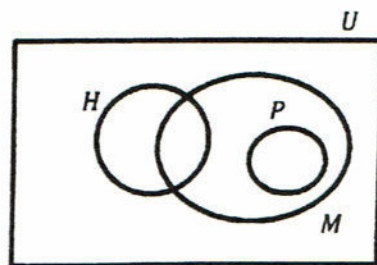
- i) No student studies both physics and history.
 ii) Some students study both mathematics and history.
 iii) Some students study both physics and chemistry.

A) none

B) i and ii

C) i

D) i, ii and iii



2. Given that $x = \frac{av+b}{v}$, which of the following correctly expresses v as the subject of the formula?

A: $v = \frac{x-b}{a}$

B: $v = \frac{b}{x-a}$

C: $v = \frac{-b}{a+x}$

D: $v = \frac{b+a}{x}$

3. If $16x^2 + bx + 100$ is a perfect square then b is

(A) 40

(B) 58

(C) 80

(D) 116

4. $(x + 3y)^2 =$

(A) $x^2 + 9y^2$

(B) $x^2 + 6y^2$

(C) $x^2 + 3xy^2 + 6y^2$

(D) $x^2 + 6xy + 9y^2$

5. The factors of $6x^2 + 5x - 4$ are

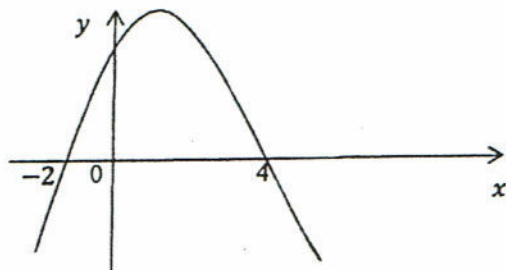
(A) $(3x + 4)(2x - 1)$

(B) $(3x - 4)(2x + 1)$

(C) $(6x - 2)(x + 2)$

(D) $(6x - 2)(x - 2)$

6.



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

7. If $f(x) = x^2 - x + 1$, then $f(-5) =$
- (A) -31
 - (B) 29
 - (C) 24
 - (D) 31

9. If $f(x) = 2x + 1$ then $ff(x)$ is
- (A) $4x^2 + 4x + 1$
 - (B) $4x + 3$
 - (C) $4x + 2$
 - (D) $4x^2 + 1$

10. Which of the following pair of vectors is parallel?

(A) $u = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$ and $v = \begin{pmatrix} -4 \\ 2 \end{pmatrix}$

(B) $u = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$ and $v = \begin{pmatrix} -4 \\ -2 \end{pmatrix}$

(C) $u = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ and $v = \begin{pmatrix} 2 \\ -4 \end{pmatrix}$

(D) $u = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ and $v = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$

11. If $|A| = 0$, then A is

- (A) an inverse matrix
- (B) a singular matrix
- (C) an identity matrix.
- (D) a non-singular matrix

8. If $f(x) = 4x - 3$, then $f^{-1}(x)$ is

(A) $\frac{1}{4x - 3}$

(B) $\frac{x + 3}{4}$

(C) $-4x - 3$

(D) $\frac{x - 4}{3}$

SECTION B

12. The diagram below shows a composite shape formed by joining two rectangles.

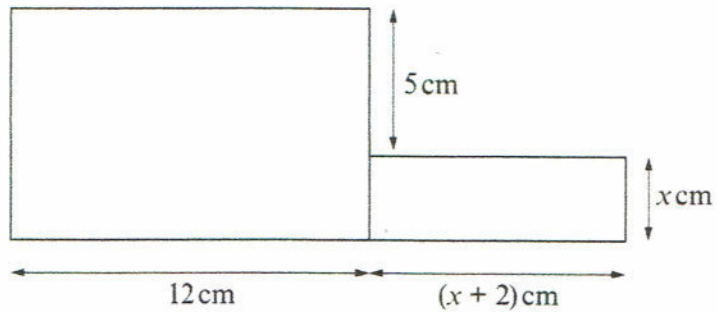


Diagram not drawn to scale

The area of the larger rectangle is $4y \text{ cm}^2$.

The area of the smaller rectangle is $y \text{ cm}^2$.

Form and solve simultaneous equations to calculate the dimensions of the smaller rectangle. Give your answers correct to 1 decimal place.

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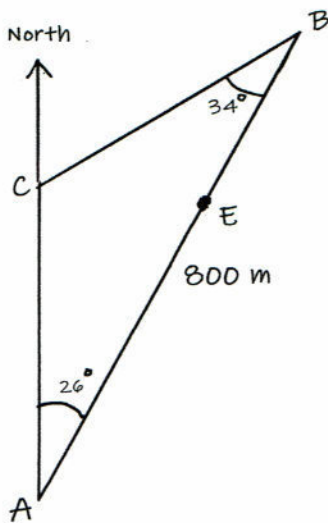
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13.



Three buoys A , B and C are positioned in Carlisle Bay to provide a course for a water sports event. $AB = 800$ m and A is due south of C . $\angle ABC = 34^\circ$ and the bearing of B from A is 026° . E is a point on AB which is 300 m from B .

(a) Calculate AC .

[3]

(b) Find the area of triangle ABC .

[2]

(c) Calculate the bearing of C from B . [2]

(d) A kite is hovering at a point vertically above E .

The angle of elevation of the kite from B is 11° . Calculate the vertical height of the kite above E . [2]

14. (a) If the matrix $P = \begin{pmatrix} 2 & -1 \\ 3 & 4 \end{pmatrix}$ and the matrix $Q = \begin{pmatrix} 5 & 4 \\ -2 & 6 \end{pmatrix}$, evaluate

(i) $2P + Q$ [2]

(ii) PQ [3]

(b) If $B = \begin{pmatrix} -6 & -2 \\ 4 & 2 \end{pmatrix}$, determine B^{-1} . [3]

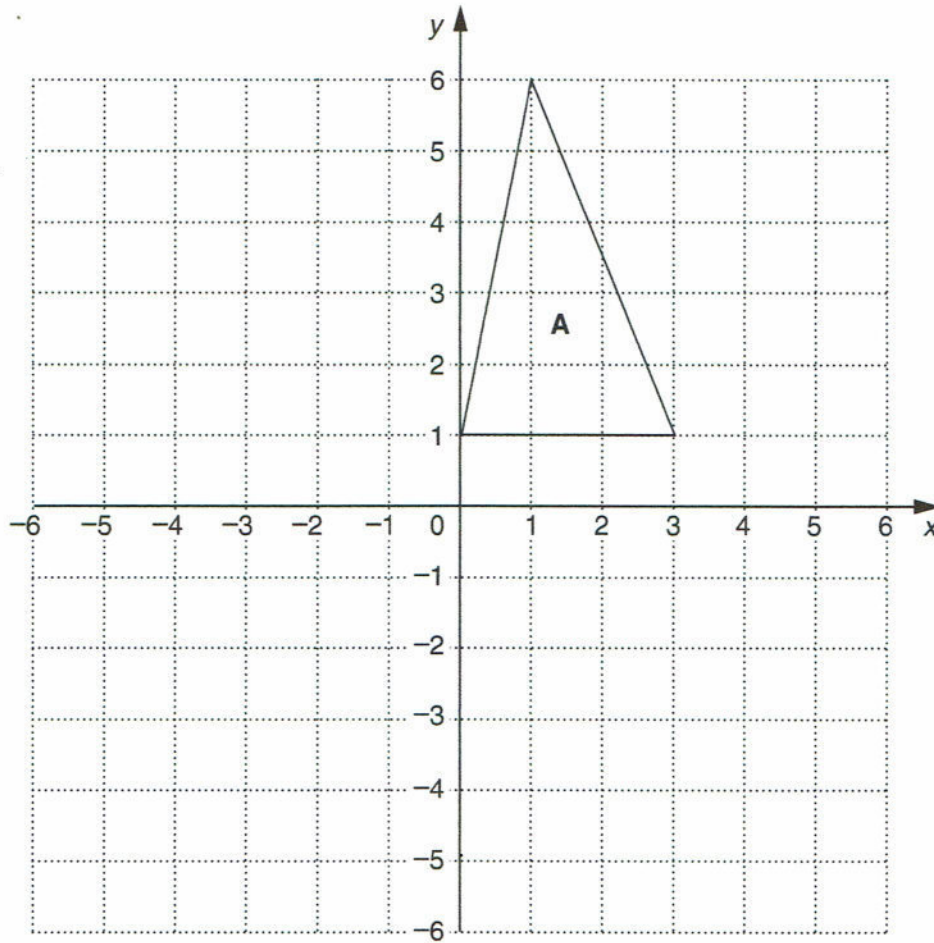
15. Given that vectors $\overrightarrow{AB} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$ and $\overrightarrow{AC} = \begin{pmatrix} -3 \\ 8 \end{pmatrix}$.

(i) Determine the column vector \overrightarrow{BC} . [2]

(ii) Find $|BC|$. [2]

(iii) P is a point such that $\overrightarrow{BP} = 3\overrightarrow{PC}$.
Find the column vector \overrightarrow{AP} . [3]

16.



(a) Triangle **A** is drawn on a 1 cm square grid.

Work out the area of triangle **A**.

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(a) _____ cm² [2]

(b) Reflect triangle **A** in the line $x = 3$.
Label the image **P**.

[2]

(c) Rotate triangle **A** 90° clockwise about (0,0).
Label the image **Q**.

[3]