FOURTH FORMS MATHEMATICS P.ST. HILL

2010 160 copies

Time: 2 hours

INSTRUCTIONS

Write your name clearly on each sheet of paper used.

Answer all questions.

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. Omission of essential working will result in 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.

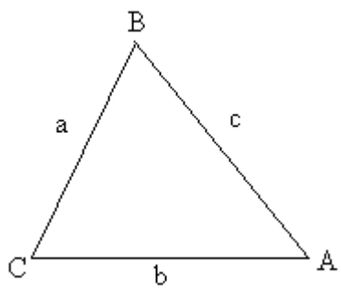
Formulae and graph paper are provided. Electronic calculators may be used.

The number of marks available is shown in the [ ] at the end of each question.

LIST OF FORMULAE

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

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

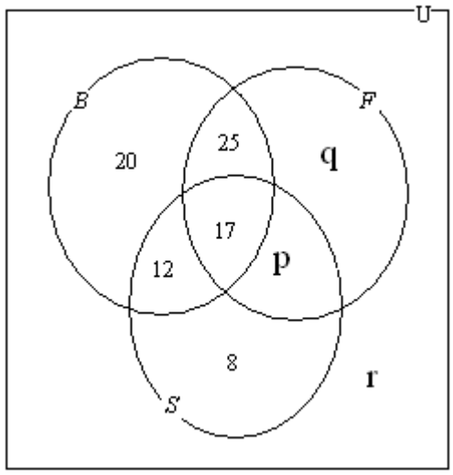


Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

1. In a survey, 100 students are asked if they like basketball (*B*), football (*F*) and swimming (*S*).

   The Venn diagram shows the results.



   42 students like swimming.

   40 students like exactly one sport.

   (a) Find the values of p, q and r. [3]

   (b) How many students like (i) all three sports, [1]

   (ii) basketball and swimming but not football? [1]

   (c) Find (i) $n(B')$ [1]

   (ii) $n((B \cup F) \cap S')$ [1]

2. (a) Make *m* the subject of the formula $k = \frac{m^2 n}{p} + f$ [4]

   (b) (i) Factorise $5a - mx + ma - 5x$ [3]

   (ii) Factorise $x^2 - 4$ [1]

   hence simplify $\frac{x^2 - 4}{2x^2 - x - 6}$ [3]

3. Solve the simultaneous equations $y = x^2 + 3x - 2$

   $y = 16 - 4x$ [5]

4. (a) A straight line, l_1, passes through the point $(4, -1)$ and has gradient $\frac{3}{2}$.
Determine the equation of the line. [3]

(b) Another line, l_2, passes through the point (0, 6). l_2 is perpendicular to l_1.
Determine the equation of the line l_2. [3]

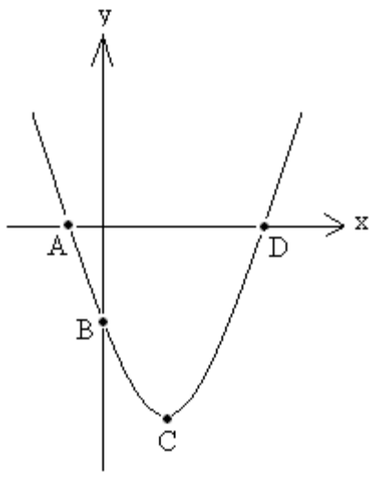
(c) l_1 and l_2 intersect at a point P. Determine the coordinates of P. [4]

5. Given $f(x) = 3x^2 - 12x - 22$

(i) write $f(x)$ in the form $a(x+h)^2 + k$ where a, h and $k \in \mathbb{R}$. [3]

(ii) solve the equation $f(x) = 0$, writing your answer(s) correct to 2 decimal places. [4]

(iii) A sketch of the graph of f(x) is shown below.



State (a) the x-coordinate of A. [1]

(b) the y-coordinate of B. [1]

(c) the x and the y-coordinates of C. [2]

(d) the x-coordinate of D. [1]

6. The functions f and g are such that

$f(x) = \frac{2x-5}{x-4}$ and $g(x) = 2x - 3$

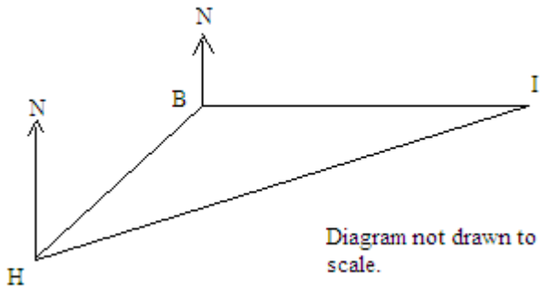
(a) Calculate the value of

(i) $g(4)$ [1]

(ii) $fg(2)$ [2]

(b) Determine an expression for $f^{-1}(x)$ [5]

7.

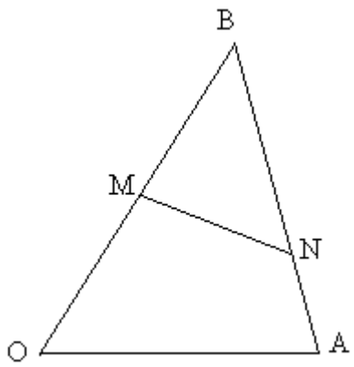


A ship sails from harbour H and travels 42 km on a bearing of 035° before reaching a marker buoy B. At this point the ship turns and travels for 56 km on bearing 090° until it reaches an island I. On the return journey, the ship travels directly back to the harbour.

Calculate (a) the distance HI. [4]

(b) the bearing of I from H. [3]

8.



In the figure above $\overrightarrow{OA} = \boldsymbol{a}$ and $\overrightarrow{OB} = \boldsymbol{b}$. The midpoint of *OB* is *M* and *N* lies on *AB* such that *BN: NA = 2:1*.

(a) Express in terms of ***a*** and ***b***, simplifying your answers where possible.

(i) $\overrightarrow{BA}$ [1]

(ii) $\overrightarrow{BN}$ [1]

(iii) $\overrightarrow{MB}$ [1]

(iv) $\overrightarrow{MN}$ [3]

The point P lies on *OA* extended so that *OA : OP = 1:2*.

(b) Show that *MNP* is a straight line. [4]