Name _____

Teacher _____

Sefton High School

2005
Preliminary
Midcourse Examination

Mathematics
Extension 1

80/80

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Attempt Questions 1 - 5
- Write using blue or black pen
- Start each question in a new answer booklet
- Board-approved calculators may be used
- All necessary working should be shown in every question

QUESTION ONE (16 marks). START A NEW BOOKLET

(a) Solve: $-7 < 3x - 5 < 9$ 2

(b) Express as a single fraction: $\frac{3}{x^2-4} - \frac{2}{x^2-3x+2}$ 3.

(c) If $A = P\left(1 + \frac{r}{100}\right)^n$, find r when $A = 1360$, $P = 1000$ and $n = 4$. Give your answer to the nearest whole number. 3.

(d) The hypotenuse of a right-angled triangle is 12cm long, and the other two sides are in the ratio 3 : 4. Find the lengths of these two sides. 3.

(e) Solve by completing the square: 3

$$x^2 + 3x = 7$$

(f) Factorise completely: $9x^3 - 72$ 2.

QUESTION TWO (16 marks) START A NEW BOOKLET.

(a) Find the values of 'x' and 'y' if 2.

$$x + \sqrt{y} = (\sqrt{5} + \sqrt{2})^2$$

(b) Find the exact value of (i) $\sin 660^\circ$ 1

(ii) $\cos(-30^\circ)$ 1

(c) Evaluate: (ii) $\sin^2 20^\circ + \sin^2 70^\circ$ 2

(iii) $\tan^2 45^\circ + \sin^2 60^\circ + \sin^2 30^\circ$ 2

(d) Simplify: $\frac{3^{n+1} + 3^{n+2}}{3^n + 3^{n-1}}$ 3

(e) Find the value of x in the domain $0^\circ \leq x^\circ \leq 360^\circ$ if $\sin x = -\frac{4}{5}$ and $\tan x > 0$ (to the nearest minute) 2

(f) If $\cos 2\theta = -0.2473$, find the value(s) of θ in the domain $0^\circ \leq \theta^\circ \leq 360^\circ$ (to the nearest minute) 3

QUESTION THREE (16 marks) START A NEW BOOKLET.

(a) Solve simultaneously for 'x' and 'y': 3

$$2x + y = 8$$
$$x^2 - x + y = 6$$

(b) Solve for θ, in the domain $0° \leq \theta° \leq 360°$ 4.

$$2\cos^2\theta - 3\sin\theta = 0$$

(c) Solve for x: 3.

$$|2x + 3| = x - 9.$$

(d) In $\triangle ABC$, $a = 4\sqrt{3}$, $b = 5$ and $\angle C = 30°$.

Find (i) the length of side c 2

(ii) area of $\triangle ABC$ 2.

(e) Express $\dfrac{1}{3\sqrt{3} - 2\sqrt{7}}$ with a rational denominator 2

QUESTION FOUR (16 marks) START A NEW BOOKLET.

(a) Prove: $\dfrac{\cos\theta}{\sqrt{1+\tan^2\theta}} + \dfrac{\sin\theta}{\sqrt{1+\cot^2\theta}} = 1$ 3.

(b) If $\sin\alpha = \frac{\sqrt{3}}{2}$, $0° \leq \alpha° \leq 90°$, and $\cos\beta = \frac{1}{\sqrt{2}}$, $0° \leq \beta° \leq 90°$, evaluate $\cos(\alpha - \beta)$, expressing your answer with a rational denominator. 3.

(c) Find all real numbers 'x' such that 3.

$$9x < x^3$$

(d) Solve for θ: $\cos\frac{\theta}{2} = -\frac{1}{2}$ (in the domain $-360° \leq \theta° \leq 360°$) 3.

(e) At two points A and B, 400 metres apart on a straight horizontal road, the top of a hill is observed.
At A, the hill is due north with an elevation of 40°.
At B, the hill is due west with an elevation of 27°.

(i) Draw a diagram showing all the above information 1.

(ii) Find expressions for AQ and QB in terms of 'h', the height of the hill. 1.

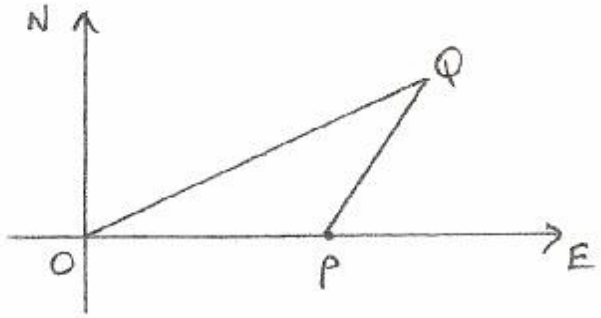
4(e) (iii) Find the height of the hill to the nearest metre. 2

QUESTION FIVE (16 marks) START A NEW BOOKLET.

(a) Prove that $\frac{1-\cos\theta}{\sin\theta} = \tan\frac{\theta}{2}$ 2

Hence obtain an exact value for $\tan 15^\circ$, in simplest surd form. 2.

(b)



Point P is 13·6 km due east of O. The bearing of Q from O is 053°, and the bearing of Q from P is 027°.

(i) Copy the diagram into your booklet, and label it with the information given. 1

(ii) Find the distance of point Q from O (correct to one decimal place). 3.

(c) Solve for x: $|x+2| - |x+1| = 1$. 4.

(d) Solve this equation for θ, $0^\circ \leq \theta^\circ \leq 360^\circ$ 4.

$$\sin\theta - \cos\theta = 1.$$

THE END : CHECK YOUR WORK.