Centre Number

Student Number

SCEGGS Darlinghurst

2009

Preliminary Course
Semester 2 Examination

Mathematics

Outcomes Assessed: P2 – P8
Task Weighting: 40%

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using blue or black pen
- Attempt **all** questions and show all necessary working
- Answer all questions on the pad paper provided
- Write your Student Number at the top of each page
- **Begin each question on a new page**
- Marks will be deducted for careless or badly arranged work
- Mathematical templates, geometrical equipment and scientific calculators may be used

Total marks – 78

- Attempt Questions 1 – 6

Question	Calc	Comm	Reasoning	Marks
1				/13
2				/13
3				/13
4				/13
5				/13
6				/13
TOTAL				**/78**

BLANK PAGE

Marks

Question 1 (13 marks)

(a) Find the value of $\sqrt{\dfrac{5.36 + 31.98}{(4.75)^2}}$ to 3 significant figures. **2**

(b) Factorise $8x^2 - 10x + 3$. **1**

(c) Express $0.1\dot{8}$ in the form $\dfrac{a}{b}$, where *a, b* are positive integers. **2**

(d) After a discount of 20% off the original marked price. Jill paid \$160 for a sweater. What was the original price of this sweater? **2**

(e) Rationalise the denominator $\dfrac{\sqrt{3}}{2 + \sqrt{3}}$ **2**

(f) Find the exact value of $\cot 210°$. **2**

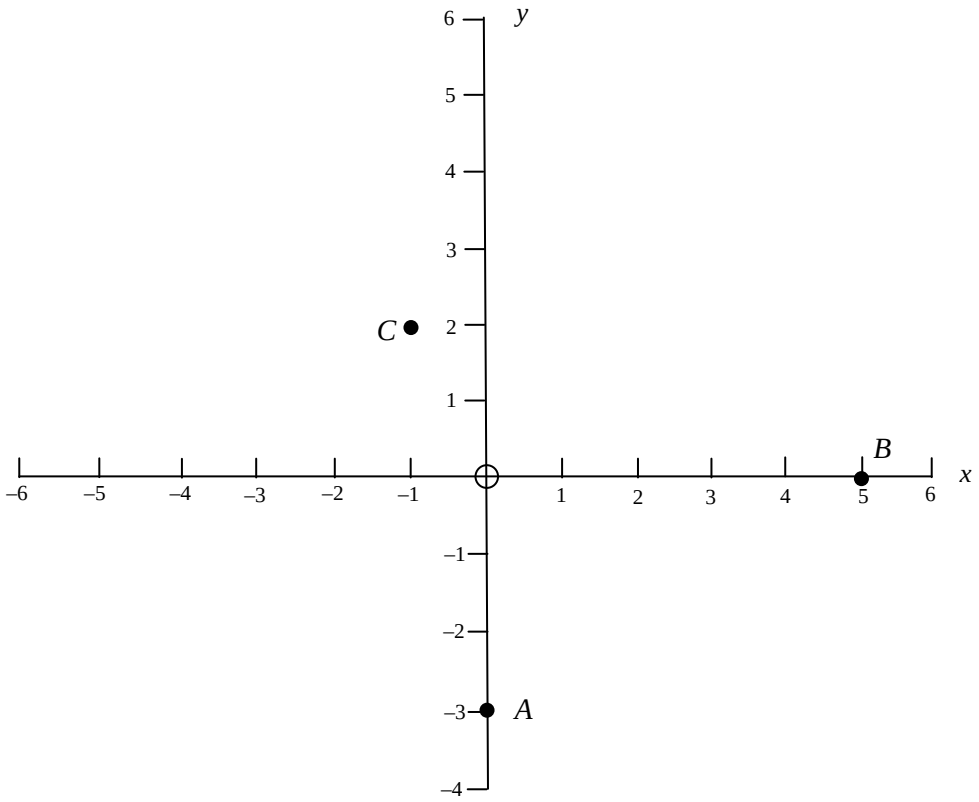
(g) Solve the equation $\dfrac{x}{3} - \dfrac{x+1}{2} = 4$. **2**

▪ **Start a new page**

Marks

Question 2 (13 marks)

(a) On the number plane $A = (0, -3)$ $B = (5, 0)$ $C = (-1, 2)$.



(i) State the co-ordinates of D such that $ABCD$ is a parallelogram. **1**

(ii) Find the length of AB as a surd. **2**

(iii) Show that the equation of AB is $3x - 5y - 15 = 0$. **2**

(iv) Find as a surd the perpendicular distance of C from AB. **2**

(v) Hence find the area of this parallelogram. **1**

Question 2 continues on the next page

Marks

Question 2 (continued)

(b) Find a quadratic equation whose roots are -5 and 2. **1**

(c) Find the domain and range $y = \dfrac{2}{x-1}$. **2**

(d) Solve $x^2 > 4$. **2**

- **Start a new page**

Marks

Question 3 (13 marks)

(a) If $f(x) = 1 - 2x$:

(i) find the value of $f(-3)$. **1**

(ii) for what value of x does $f(x) = 5$? **1**

(b) A parabola has equation $(x-3)^2 = 16(y+1)$.

Find:

(i) the vertex. **1**

(ii) the focus. **1**

(iii) the equation of the directrix. **1**

(iv) the equation of the axis of symmetry. **1**

(c) If α and β are the roots of the equation $x^2 - 2x + 4 = 0$, find the value of:

(i) $\dfrac{1}{\alpha} + \dfrac{1}{\beta}$ **2**

(ii) $\alpha^2 + \beta^2$ **2**

(iii) $\dfrac{2-\alpha}{1+\beta} + \dfrac{2-\beta}{1+\alpha}$ **3**

▪ **Start a new page**

Marks

Question 4 (13 marks)

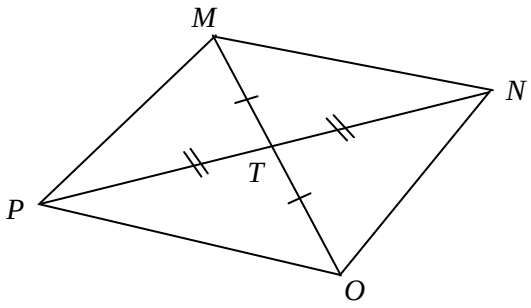
(a) The point $P(x, y)$ moves such that its distance from the point $A(2, -4)$ is twice its distance from the point $B(-1, 2)$.

(i) Show that the equation of the locus of the point $P(x, y)$ is $x^2 + 4x + y^2 - 8y = 0$. **2**

(ii) Find the centre and radius of this circle. **2**

(b) Find the equation of the normal to the curve $y = \sqrt{x+2}$ at the point $(7, 3)$. **3**

(c) The diagonals of a quadrilateral *MNOP* intersect at *T*. **3**
Given $MT = OT$ and $NT = PT$, prove $MN = OP$.



(d) Solve for x if $|x - 2| = 2x - 1$. **3**

▪ **Start a new page**

Marks

Question 5 (13 marks)

(a) (i) Write down the discriminant of $2x^2 + 3x + k$. **1**

(ii) For what values of k does $2x^2 + 3x + k = 0$ have no real roots. **1**

(b) Differentiate each of the following.

(i) $y = 3x^2 + 9x - 5$ **1**

(ii) $y = \dfrac{3x}{x^2 - 2x}$ **2**

(iii) $y = (x-5)^2 (2x+3)$ **2**

(c) From a port P a lighthouse L is seen 2.4km away on a bearing of $035°$.
A boat leaves port and sails due East to a point B, 4.2km from the lighthouse.

(i) Draw a diagram showing this information **1**

(ii) Calculate the size of $\angle LBP$, to the nearest degree. **2**

(iii) Hence find the bearing of the boat from the lighthouse. **1**

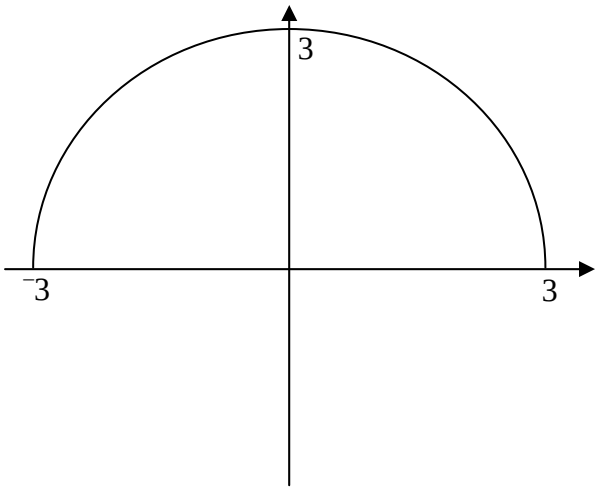
(d) If $\cos x > 0$ and $\sin x = -\dfrac{8}{17}$, find the exact value of $\tan x$. **2**

▪ **Start a new page**

Marks

Question 6 (13 marks)

(a) (i) Write down the equation of this semicircle. **1**



(ii) Prove that this is an even function. **2**

(b) The interior angles of a regular polygon are 135º. **2**
Find the number of sides in the polygon.

(c) (i) Draw a neat sketch showing the graphs $x^2 + y^2 = 4$ and $y = 2^x$. **2**

(ii) Shade the region on your sketch where $x^2 + y^2 \leq 4$ and $y \leq 2^x$. **1**

(d) Solve the equation $\sin x = -\frac{1}{2}$ for $0 \leq x \leq 360°$. **2**

(e) Prove $\frac{1 + \cot x}{1 + \tan x} = \cot x$. **3**

End of Paper

BLANK PAGE