



SCEGGS Darlinghurst

2007

Preliminary Course

Assessment Task 3  
Wednesday 6 June 2007

# Mathematics

Task Weighting: 15%  
Outcomes Assessed: P2, P3 and P4

## General Instructions

- Time allowed – 55 minutes
- You are allowed to bring in one A4 handwritten page of notes
- Write your Student Number at the top of each page
- Begin each question on a new page
- Attempt all questions and show all necessary working
- Answer all questions on the pad paper provided
- Marks will be deducted for careless or badly arranged work
- Mathematical templates, geometrical equipment and scientific calculators may be used

[Redacted]

Centre Number

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Student Number

Total marks – 36

- Attempt Questions 1 – 3

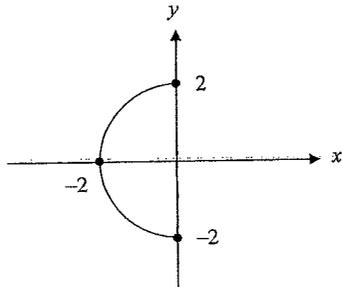
Question	Reasoning	Communication	Marks
1	/2	/7	/12
2	/3	/2	/12
3	/5	/1	/12
<b>TOTAL</b>	<b>/10</b>	<b>/10</b>	<b>/36</b>

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**Question 1** (12 marks)

Marks

- (a) Given  $f(x) = 2 - x^2$
- (i)  $f(3)$  1
- (ii)  $f(1) + f(4)$  1
- (b) Find the exact value of  $\operatorname{cosec} 225^\circ$ . 1
- (c) Consider the following graph. 2



Does it represent a function? Explain your answer.

- (d) Given that  $\sin \theta = \frac{3}{8}$  and  $\tan \theta < 0$ , find the exact value of  $\cos \theta$ . 2
- (e) Sketch the curve  $y = 3 \sin 2x$  for  $0^\circ \leq x \leq 360^\circ$ . 2
- (f) (i) Explain what is meant by an asymptote. 1
- (ii) Sketch the curve  $y = \frac{2}{x-1}$  showing all important features. 2

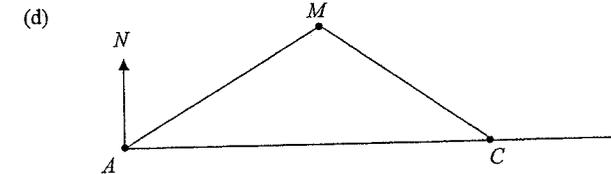
• Start a new page

Marks

**Question 2** (12 marks)

- (a) Show that the function  $f(x) = x^2 - 1$  is even. 2
- (b) (i) Sketch the curve  $y = \sqrt{16 - x^2}$  1
- (ii) State the domain and range of the function. 2
- (c) Solve for  $0^\circ \leq x \leq 360^\circ$  2

$$2 \sin x = -1$$



Adriana and Charlotte are bushwalking in the Royal National Park. Charlotte (C) is due east of Adriana (A).

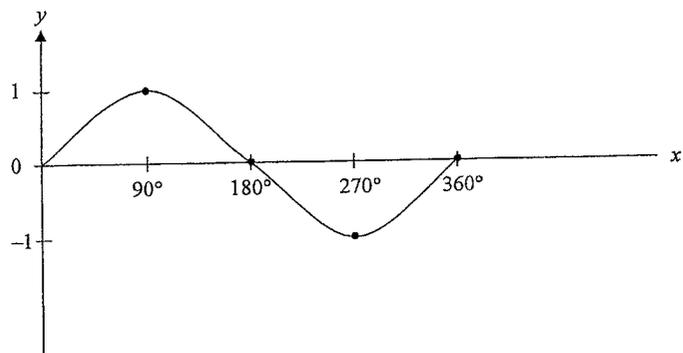
From their positions they see a mountain (M). M is 38 km from A and 20 km from C.

The bearing of the mountain (M) from Charlotte (C) is  $325^\circ$ .

- (i) Copy the diagram, show all the given information. 1
- (ii) Find the size of  $\angle ACM$ . 1
- (iii) What is the bearing of the mountain (M) from Adriana (A)? (Answer to the nearest degree.) 3

Question 3 (12 Marks)

(a) The curve  $y = \sin x$  is shown for  $0^\circ \leq x \leq 360^\circ$ .



- (i) Copy the diagram and on the same set of axes, draw the graph of  $y = \cos x$ . 1
- (ii) By solving the equation  $\sin x = \cos x$ , find the exact values of  $x$  where the two curves intersect. 2

(b) A function is defined by  $f(x) = |2x + 3|$ . 2  
Find the values of  $x$  for which  $f(x) = 10$ .

(c) A function is given by: 2

$$f(x) = \begin{cases} x^2 & x \leq -1 \\ x + 2 & -1 < x < 2 \\ 4 & x \geq 2 \end{cases}$$

Evaluate  $f(0) - 2f(3)$ .

Question 3 continues on the next page

Question 3 (continued)

(d) Determine the point(s) of intersection for the functions: 2

$$y = 2x - 3$$

$$y = x^2 - 6x + 12$$

(e) Prove that: 3

$$\frac{\cos \theta}{1 + \sin \theta} - \frac{\cos \theta}{1 - \sin \theta} = -2 \tan \theta$$

End of paper

QUESTION 1,

a)  $f(x) = 2 - x^2$   
 1)  $f(3) = 2 - (3)^2$   
 $= 2 - 9$   
 $= -7$  ✓  
 11)  $f(1) + f(4)$   
 $= (2 - 1^2) + (2 - 4^2)$   
 $= 1 + (-14)$   
 $= -13$  ✓

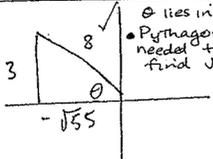
Comments  
 part a) was well done. Just some silly algebraic mistakes. Be careful.

b)  $\frac{1}{\sin 225^\circ} = \frac{1}{\sin(180+45)^\circ}$   
 $= \frac{1}{-\sin 45^\circ}$   
 $= \frac{1}{-\frac{1}{\sqrt{2}}}$   
 $\checkmark = -\sqrt{2}$

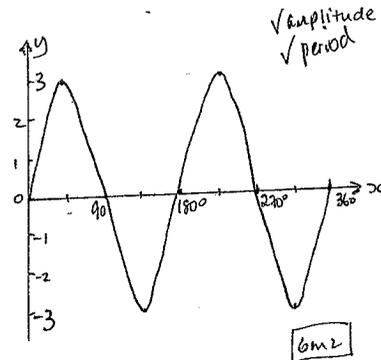
$\sin \theta$  is negative in quadrant 3.

c) No. Using the vertical line test, it cuts the curve more than once. It does not have one to one correspondence. ✓

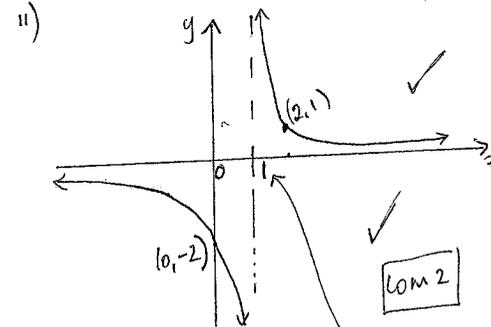
Comm 1  
 This was done quite well but please make sure you use the right words.

d)   
 •  $\theta$  lies in Quadrant 2.  
 • Pythagoras rule needed to find  $\sqrt{55}$  Reas 2  
 $\cos \theta = \frac{-\sqrt{55}}{8}$  ✓

$\theta$  is located in Quadrant 2 so  $\cos \theta$  has to be negative. Although most people used Pythagoras' rule correctly, the final sign is very important.



1) A line that a graph approaches but never touches 6m1



one mark  
 correct asymptote at  $x=1$

one mark  
 y-intercept clearly shown at  $(0, -2)$

To save time, learn how to sketch curves like this without plotting points.

Note this value at  $x=1$  must be very clearly seen.

Q2

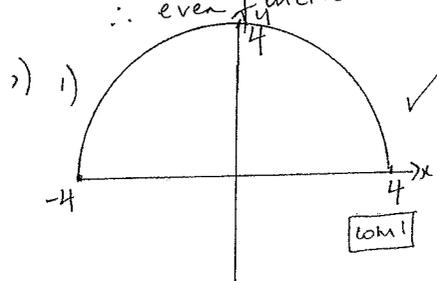
$$1) \quad f(x) = -x^2 - 1$$

$$f(-x) = -(-x)^2 - 1$$

$$= -x^2 - 1$$

$$f(x) = f(-x)$$

$\therefore$  even function



ii)

$$-4 \leq x \leq 4 \quad \checkmark$$

$$0 \leq y \leq 4 \quad \checkmark$$

3)

$$2 \sin x = -1$$

$$\sin x = -\frac{1}{2}$$

Q 3 + 4  $\theta = 30^\circ$

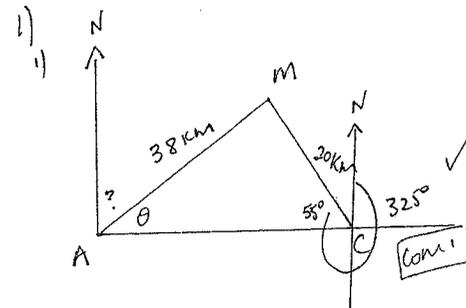
$$180 + \theta = 210^\circ \quad \checkmark$$

$$360 - \theta = 330^\circ \quad \checkmark$$

Some careless mistakes made when setting out this Q. Remember to put the substitution inside the brackets + be careful of yr signs

Well done. Remember to use < rule and a compass.

Sin is -ve in 2 Quads  
3 + 4  $\therefore$  2 solutions



ii)

$$\angle ACM = 325^\circ - 270^\circ$$

$$= 55^\circ$$

ii)

$$\frac{20}{\sin \theta} = \frac{38}{\sin 55^\circ} \quad \checkmark$$

$$\sin \theta = \frac{20 \sin 55^\circ}{38}$$

$$\theta = \sin^{-1} \left( \frac{20 \sin 55^\circ}{38} \right)$$

$$= 26^\circ \quad \checkmark$$

$\therefore$  Bearing of m from A

$$= 90 - 26^\circ$$

$$= 064^\circ T \quad \checkmark \quad \text{Reas 3}$$

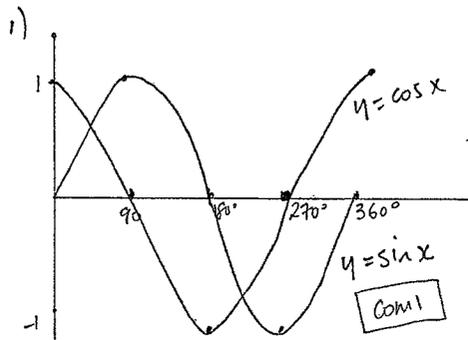
Again, your diagrams need to be neat and easily read. Draw them big make sure to show the bearing.

This part was poorly answered. Some students didn't even attempt this part, losing valuable marks.

Not forgot to find the bearing after finding the angle.

Remember a bearing is written  $064^\circ T$ .

Q3



The graph was done well by most students. One or two drew them as straight lines so please remember it is a curve! Some students were also a little sloppy with where the turning points are!

COM1

1)  $\sin x = \cos x$  Reas 2

$\frac{\sin x}{\cos x} = 1$   $45^\circ$  ✓  
 $\tan x = 1$   $225^\circ$  ✓

Done partly by a majority of students. Very few solved the equation for  $x=1$  but even those that did forget there were 2 solutions (even though the curves cut at two points)

1)  $f(x) = |2x+3|$

$10 = 2x+3$

$7 = 2x$

$\frac{7}{2} = x$  ✓

$10 = -(2x+3)$

$10 = -2x-3$

$13 = -2x$

$-\frac{13}{2} = x$  ✓

Many students didn't know they had to solve an equation. The most common mistake was to substitute  $x$  into  $|2x+3|$ . For those who did successfully don't forget you don't really need to check your solutions.

1)  $f(0) = 0+2 = 2$  ✓  
 $2f(3) = 2(4) = 8$  ✓  
 $2-8 = -6$

1)  $2x-3 = x^2-6x+12$   
 $x^2-8x+15 = 0$   
 $(x-5)(x-3) = 0$   
 $x=5$   $x=3$

$y = 2x - 3$ $= 2(5) - 3$ $= 7$ $(5, 7)$ ✓	$y = 2x - 3$ $= 2(3) - 3$ $= 3$ $(3, 3)$ ✓
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1) LHS  $\frac{\cos \theta}{1+\sin \theta} - \frac{\cos \theta}{1-\sin \theta}$   
 $= \frac{\cos \theta(1-\sin \theta) - \cos \theta(1+\sin \theta)}{(1+\sin \theta)(1-\sin \theta)}$   
 $= \frac{\cancel{\cos \theta} - \cos \theta \sin \theta - \cancel{\cos \theta} - \cos \theta \sin \theta}{\cos^2 \theta}$   
 $= \frac{-2 \cos \theta \sin \theta}{\cos^2 \theta}$   
 $= \frac{-2 \sin \theta}{\cos \theta}$  ✓ Reas 3

This was done reasonably well although I did see  $f(0) = 0$   $\therefore 0-8 = -8$ . I also saw  $x+2-8$ . It is a numerical substitute not an algebraic one.

Many students did not know when how to start this question!! Remember to find points of intersection you solve simultaneously.

Done reasonably well by students. It was pleasing to see a majority of students were able to take the algebraic and digrammatic manipulations. Just be careful of the minus sign when you put everything over the common denominator.