

**SYDNEY TECHNICAL HIGH SCHOOL**  
**MATHEMATICS**  
**YEAR 11**  
**2 UNIT COMMON**  
**MAY 2003**

Name: \_\_\_\_\_

Teacher: \_\_\_\_\_

Instructions:    Time Allowed:      70 mins.

- Show necessary working
- Full marks may not be given for incomplete working
- Approximate marks are shown but may be slightly varied.

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Total
/7	/7	/7	/7	/7	/7	/7	/8	/57

**Question 1**

- a) Evaluate  $V = \frac{4}{3}\pi r^3$  when  $r = 6400$ . Give your answer in scientific notation using 2 significant figures. (2)
- b) Express  $0.\dot{4}\dot{5}$  in simplest fraction form (2)
- c) Simplify  $\sqrt{50} + 3\sqrt{8}$  (1)
- d) Express  $\frac{\sqrt{2}}{3\sqrt{2}+1}$  with a rational denominator (2)

**Question 2**

- a) Expand and simplify  $3x - (x+3)^2$  (2)
- b) Factorise fully : (i)  $16a^2 - 9$  (1)  
(ii)  $2x^2 - 2x - 24$  (1)  
(iii)  $x^3 + 8$  (1)
- c) Solve  $3x^2 - 2x - 1 = 0$  (2)

**Question 3**

- a) Evaluate  $-3|-2| + |-3|^2$  (1)
- b) Simplify: (i)  $\frac{3x-6}{x} \times \frac{x}{x-2}$  (2)  
(ii)  $\frac{3x-6}{x} - \frac{x}{x-2}$  (2)
- c) Find the simultaneous solution to  $5x - 2y = 1$   
 $8x - y = -5$  (2)

**Question 4**

Solve:

- a)  $|2x - 3| = 7$  (2)
- b)  $|4 - x| < 5$  and show the solution on a number line (3)
- c)  $9^{1-x} = \frac{3}{\sqrt{3}}$  (2)

### Question 5

- a) Give the domain and range of each function : (i)  $y = \sqrt{x-1}$  (2)  
(ii)  $y = \frac{1}{x^2}$  (2)
- b) (i) Sketch the parabola  $y = -x(x-3)$  for  $0 \leq x \leq 4$  (2)  
(ii) Find the range for the above function given the restricted domain (1)

### Question 6

Sketch each function below. Show  $x$ ,  $y$  intercepts and other important points clearly:

- a)  $y = |x+1|$  (2)
- b)  $y = \frac{-1}{x} + 2$  (2)
- c)  $y = \begin{cases} x+1, & \text{for } x < 0 \\ x^2 - 4, & \text{for } x \geq 0 \end{cases}$  (3)

### Question 7

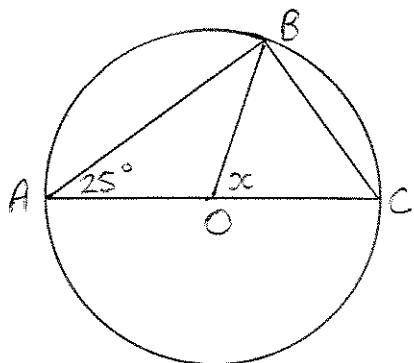
- a) Given that  $|x|=x$  if  $x \geq 0$  and

$$|x|=-x \text{ if } x < 0,$$

- (i) Simplify the function  $y = x + |x|$  when (α)  $x < 0$  (1)  
(β)  $x \geq 0$  (1)
- (ii) Hence, or otherwise, sketch the function  $y = x + |x|$  (1)
- b) Sketch the region satisfied by the intersection of  $y \leq \sqrt{4-x^2}$  and  $y > -3$  (4)

**Question 8**

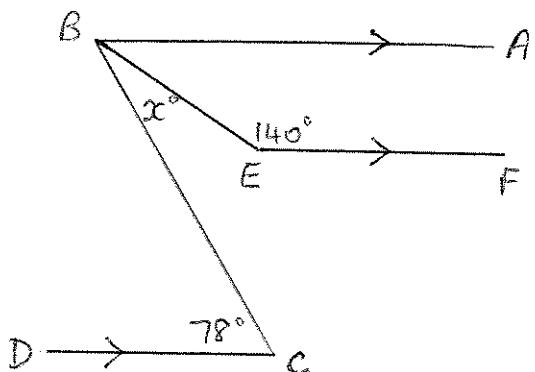
a)



Given a circle with diameter AC and centre O.

- (i) How do we know that  $x = 50^\circ$ ? (2)
- (ii) Find the size of  $\angle ABC$  (1)  
(reasons not necessary)

b)

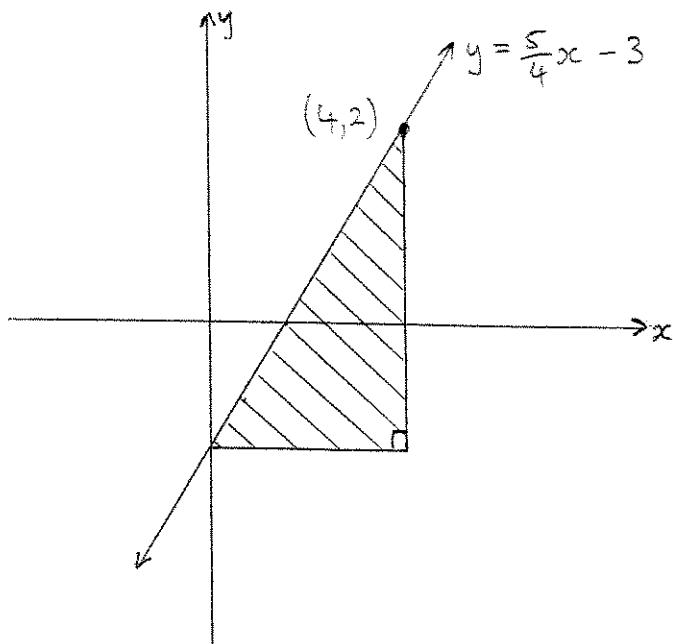


Find  $x$ , giving properly set out geometrical reasons. (2)

c) Find the

inequalities whose intersection define the shaded region.

(3)



# SOLUTIONS.

D) a)  $1.1 \times 10^{12}$

$\nwarrow \quad \nwarrow$

$\textcircled{1} \quad \textcircled{1}$

b) Let  $x = 0.4555\ldots$

$10x = 4.5555\ldots$

$9x = 4.1$

$\therefore x = \frac{4.1}{9}$

$= \frac{41}{90} \quad \textcircled{1}$

●  $5\sqrt{2} + 6\sqrt{2} = 11\sqrt{2} \quad \textcircled{1}$

d)  $\frac{\sqrt{2}}{3\sqrt{2}+1} \times \frac{3\sqrt{2}-1}{3\sqrt{2}-1} = \frac{6-\sqrt{2}}{17} \quad \textcircled{1}$

(2)

a)  $3x - (x^2 + 6x + 9) = 3x - x^2 - 6x - 9$

$\textcircled{1} \quad \quad \quad = -3x - x^2 - 9 \quad \textcircled{1}$

● i)  $(4a+3)(4a-3) \quad \textcircled{1}$

ii)  $2(x-4)(x+3) \quad \textcircled{1}$

iii)  $(x+2)(x^2 - 2x + 4) \quad \textcircled{1}$

c)  $x = \frac{2 \pm \sqrt{4 - 4 \times 3 \times 1}}{6} \quad \textcircled{1}$

$= \frac{2 \pm \sqrt{4+12}}{6}$

$= \frac{2 \pm 4}{6}$

$= 1 \text{ or } -\frac{1}{3} \quad \textcircled{1}$

3) a)  $-3x^2 + 3^2 = -6 + 9$

$= 3 \quad \textcircled{1}$

b) (i)  $\frac{3(x-2)}{x} \times \frac{x}{x-2} = 3 \quad \textcircled{1}$

(ii)  $\frac{(3x-6)(x-2) - x^2}{x(x-2)} \quad \textcircled{1}$

$= \frac{3x^2 - 12x + 12 - x^2}{x(x-2)}$

$= \frac{2x^2 - 12x + 12}{x(x-2)} \quad \textcircled{1}$

c)  $5x - 2y = 1 \quad \textcircled{1}$

$8x - y = -5 \quad \textcircled{2}$

②  $x - 2 : -16x + 2y = 10 \quad \textcircled{3}$

① + ③ :  $-11x = 11$

$x = -1 \quad \leftarrow 1 \text{ mark}$

Sub in ① :  $-5 - 2y = 1$

$-2y = 6$

$y = -3 \quad \leftarrow 1 \text{ mark}$

1 mark if method has an error  
but rest is OK

$\underline{\underline{(3x+1)(x-1) = 0}} \quad \textcircled{1}$

$\therefore x = -\frac{1}{3} \text{ or } 1 \quad \textcircled{1}$

1 mark for only 1 answer

4) a)  $2x - 3 = 7$  or  $-(2x - 3) = 7$

$$2x = 10 \quad \text{or} \quad -2x + 3 = 7$$

$$x = 5 \quad \checkmark \quad -2x = 4$$

$$x = -2 \quad \checkmark$$

$$\therefore x = 5 \text{ or } -2 \quad \textcircled{1}$$

b)  $4 - x < 5$  or  $-(4 - x) < 5$

$$-x < 1 \quad -4 + x < 5$$

$$x > -1 \quad \textcircled{1} \quad x < 9 \quad \textcircled{1}$$

$$\therefore -1 < x < 9$$

c)  $(3^2)^{1-x} = 3^1 \div 3^{\frac{1}{2}}$   
 $3^{2-2x} = 3^{\frac{1}{2}} \quad \textcircled{1}$

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

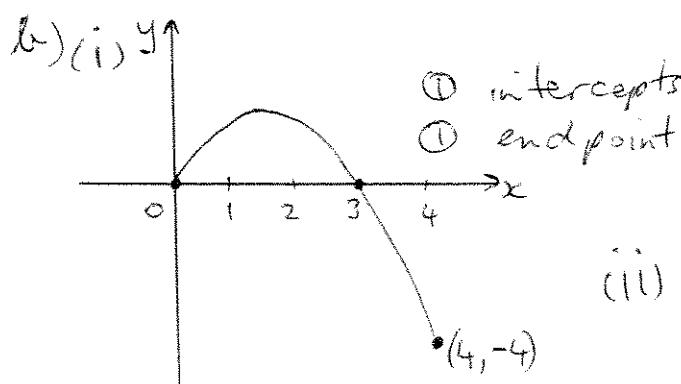
$$\therefore -2x = -\frac{1}{2}$$

$$\therefore x = \frac{3}{4} \quad \textcircled{1}$$

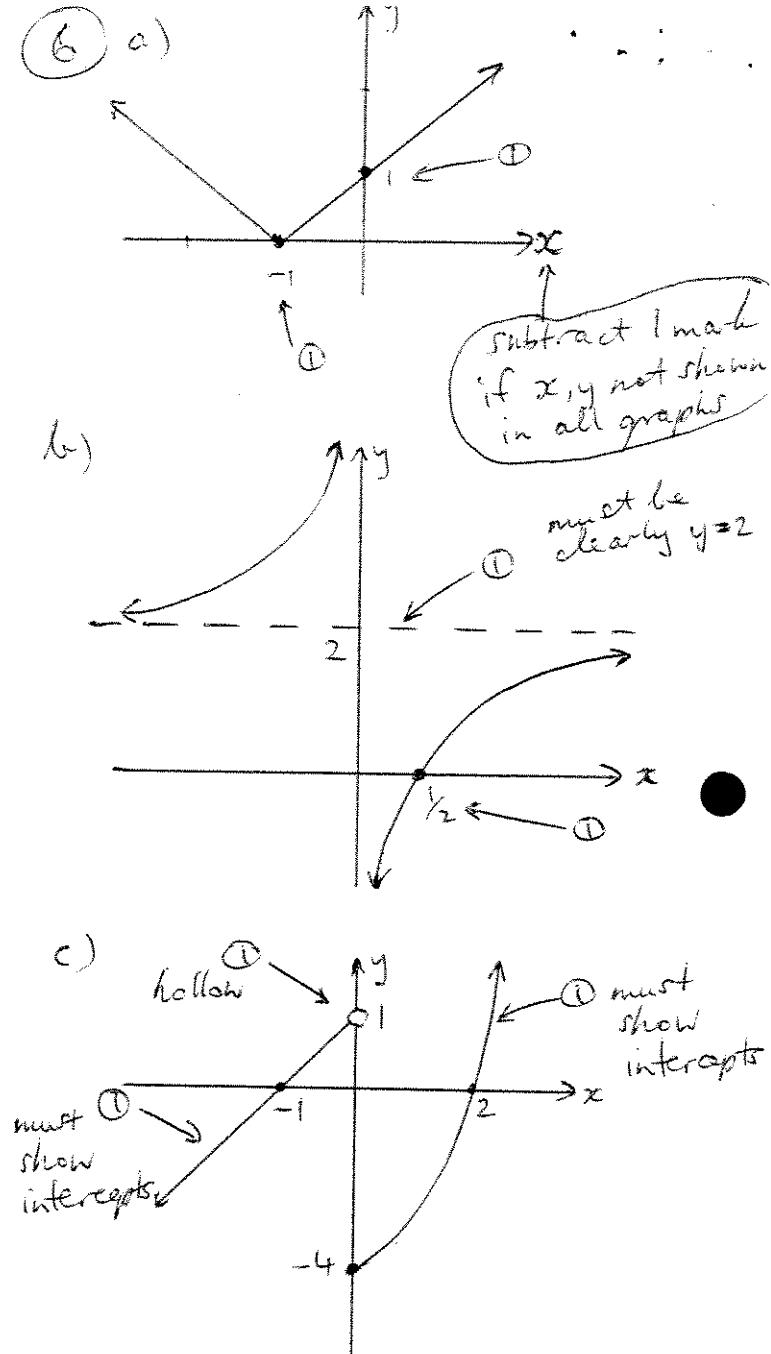
5) a) (i) D:  $x \geq 1 \quad \textcircled{1}$   
R:  $y \geq 0 \quad \textcircled{1}$

(ii) D: all  $x$ , except  $x=0$   $\textcircled{1}$   
(do not accept "except  $x \neq 0$ ")

R:  $y > 0 \quad \textcircled{1}$



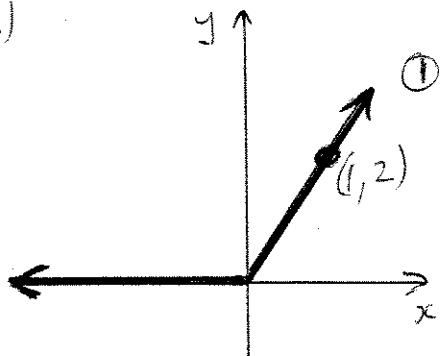
(ii)  $-4 \leq y \leq 2\frac{1}{4} \quad \textcircled{1}$



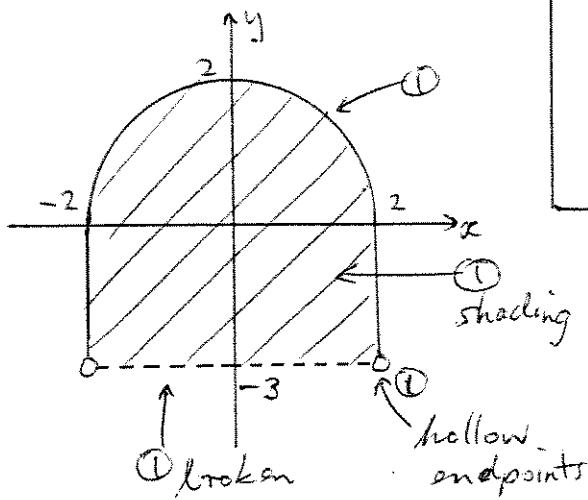
7) a) (i) (2)  $y = x + \epsilon x$   
 $\therefore y = 0 \quad \textcircled{1}$

(β)  $y = x + x$   
 $\therefore y = 2x \quad \textcircled{1}$

(ii)



b.)



b)  $\angle ABC = 102^\circ$  (att. L's equal,  
 $DC \parallel BA$ )  $\textcircled{1}$   
 must have

$\angle ABE = 40^\circ$  (oint. L's supp.  
 $BA \parallel EF$ )  $\textcircled{1}$

$\therefore x = 38^\circ$

must have

c)  $y \leq \frac{5}{4}x - 3 \quad \textcircled{1}$

$y \geq -3 \quad \textcircled{1}$

$x \leq 4 \quad \textcircled{1}$

8) a) (i)  $\triangle ABO$  is isosceles  
 $(OA = OB)$   
 $\angle ABO = 25^\circ$  (base L's equal)  
 $\therefore x = 50^\circ$  (ext. L of  $\triangle ABO$ )  $\textcircled{1}$

(ii)  $90^\circ \quad \textcircled{1}$