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 $0.4\dot{5}$ 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* $0 \le x \le 4$ (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) $y = \begin{cases} x+1, \text{for } x < 0 \\ x^2 - 4, \text{for } x \ge 0 \end{cases}$ (3)

Question 7

a) Given that $|x| = x$ *if* $x \geqslant 0$ and

$|x| = -x$ *if* $x < 0$,

(i) Simplify the function $y = x + |x|$ when (α) $x < 0$ (1)

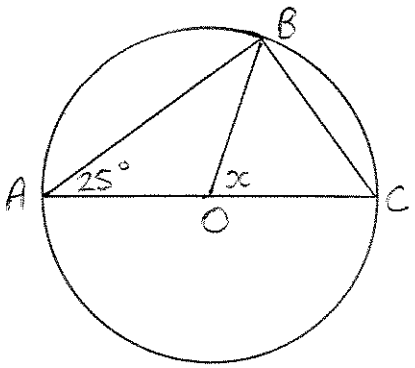
(β) $x \geqslant 0$ (1)

(ii) Hence, or otherwise, sketch the function $y = x + |x|$ (1)

b) Sketch the region satisfied by the intersection of $y \le \sqrt{4-x^2}$ *and* $y > -3$ (4)

Question 8

a)

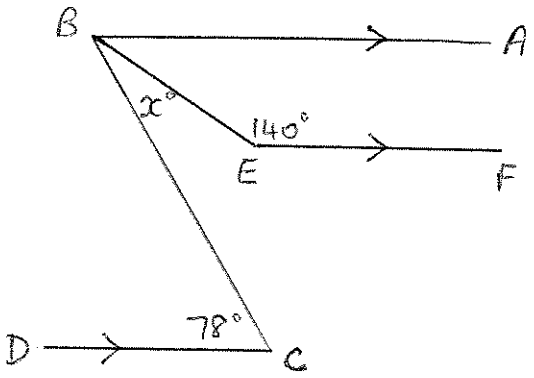


Given a circle with diameter AC and centre O.

(i) How do we know that $x = 50°$? (2)

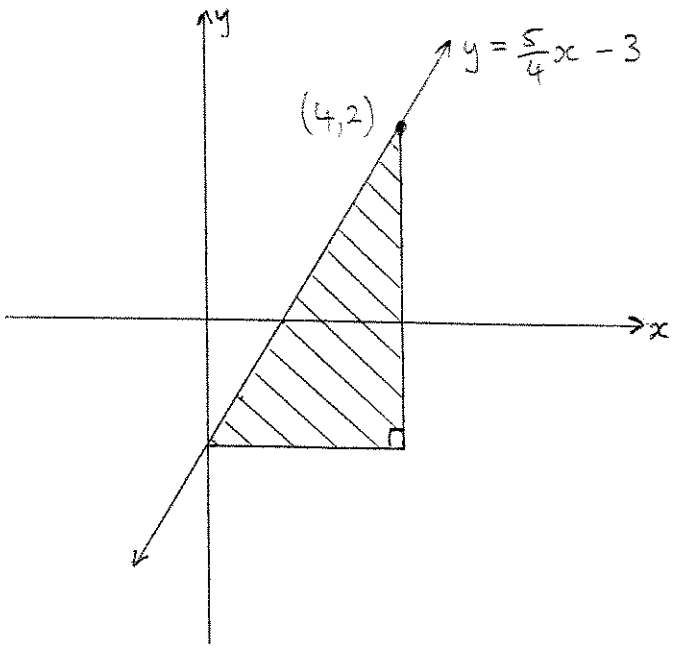
(ii) Find the size of $\angle ABC$ (1)
(reasons not necessary)

b)



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

c)Find the inequalities whose intersection define the shaded region. (3)



SOLUTIONS.

1 a) 1.1×10^{12} ① ①

b) Let $x = 0.4555\ldots$
$10x = 4.5555\ldots$ } ① method
$9x = 4.1$
$\therefore x = \frac{4.1}{9}$
$= \frac{41}{90}$ ①

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

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

2

a) $3x - (x^2+6x+9) = 3x - x^2 - 6x - 9$
①
$= -3x - x^2 - 9$
①

● (i) $(4a+3)(4a-3)$ ①

(ii) $2(x-4)(x+3)$ ①

(iii) $(x+2)(x^2-2x+4)$ ①

c) $x = \frac{2 \pm \sqrt{4 - 4\times3\times-1}}{6}$ ①

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

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

$= 1$ or $-\frac{1}{3}$ ①

3 a) $-3\times2 + 3^2 = -6+9$
$= 3$ ①

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

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

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

$= \frac{2x^2 - 12x + 12}{x(x-2)}$ ①

c) $5x - 2y = 1$ —— ①
$8x - y = -5$ —— ②

② $\times -2$: $-16x + 2y = 10$ —— ③

① + ③ : $-11x = 11$

$\boxed{x = -1}$ ← 1 mark

Sub in ① : $-5 - 2y = 1$

$-2y = 6$

$\boxed{y = -3}$ ← 1 mark

1 mark if method has an error but rest is OK

or $(3x+1)(x-1) = 0$ ①

$\therefore x = -\frac{1}{3}$ or 1 ①

1 mark for only 1 answer

(4) 1 mark for 2 equations

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

$2x=10$ or $-2x+3=7$

$x=5$ ✓ $-2x=4$

$x=-2$ ✓

$\therefore x=5$ or -2 ①

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

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

$x>-1$ ① $x<9$ ①

$\therefore -1<x<9$

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

$3^{2-2x} = 3^{\frac{1}{2}}$ ①

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

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

$\therefore x = \frac{3}{4}$ ①

(5) a) (i) D: $x \geq 1$ ①

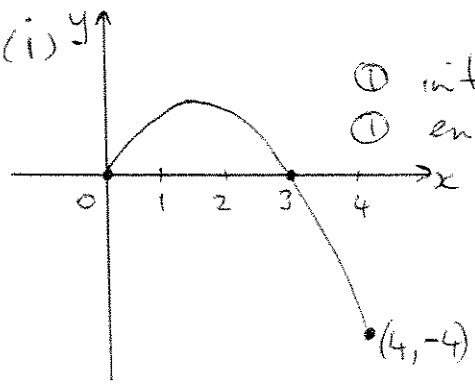
R: $y \geq 0$ ①

(ii) D: all x, except $x=0$ ①

do not accept "except $x \neq 0$"

R: $y>0$ ①

b) (i)

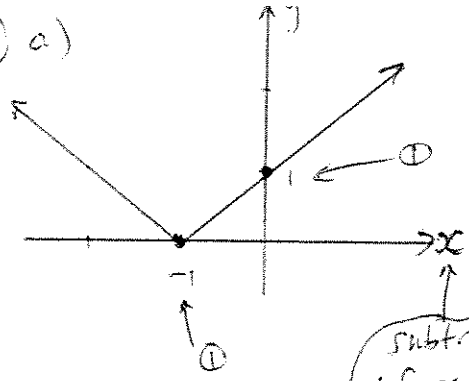


① intercepts

① endpoint

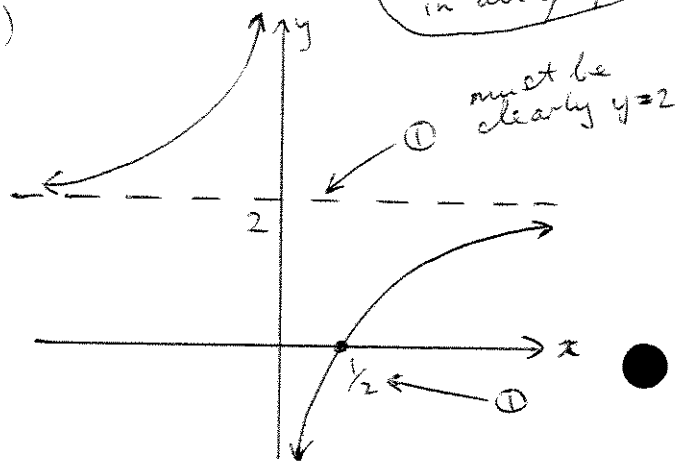
(ii) $-4 \leq y \leq 2\frac{1}{4}$ ①

(6) a)

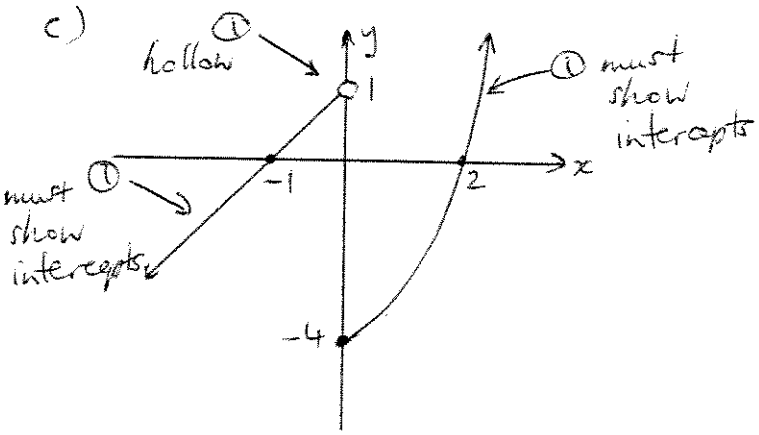


subtract 1 mark if x, y not shown in all graphs

b)



c)



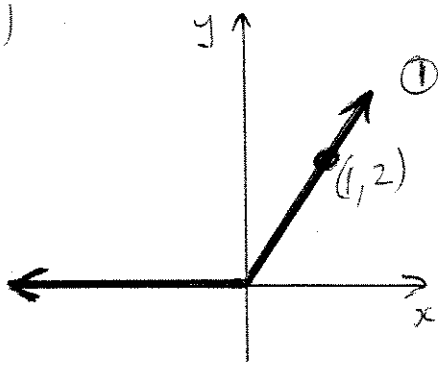
(7) a) (i) (α) $y = x + (-x)$

$\therefore y = 0$ ①

(β) $y = x + x$

$\therefore y = 2x$ ①

(ii)



①

b) $\angle ABC = 102°$ (alt. ∠'s equal, DC // BA) ①

must have

$\angle ABE = 40°$ (coint. ∠'s supp. BA // EF) ①

must have

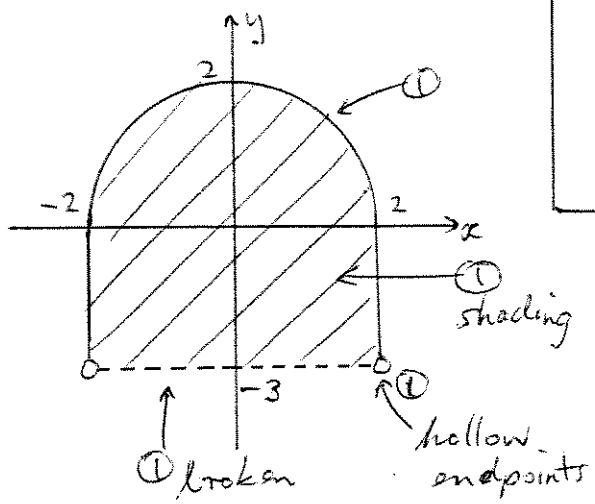
$\therefore x = 38°$

c) $y \leq \frac{5}{4}x - 3$ ①

$y \geq -3$ ①

$x \leq 4$ ①

b)



(8) a) (i) $\triangle AOB$ is isosceles ($OA = OB$)

$\angle ABO = 25°$ (base ∠'s equal) ①

$\therefore x = 50°$ (ext. ∠ of $\triangle AOB$) ①

(ii) 90° ①