

# **SYDNEY TECHNICAL HIGH SCHOOL**

## **MATHEMATICS**

**2 UNIT**

**YEAR 11 COMMON TEST 1**

**MAY 2005**

*Time Allowed : 70 minutes*

### **Directions to Candidates**

- Attempt ALL questions.
- Approximate marks are shown alongside each question.
- All necessary working should be shown in every question. Marks may be deducted for careless or badly arranged work.
- Board-approved calculators may be used.
- At the conclusion of the exam hand in the question paper with your solutions.

### Question 1

- a) Evaluate  $\frac{7.2}{3.4 \times 10^{-2}}$  to 2 decimal places (1)
- b) Write 7862 correct to 2 significant figures. (1)
- c) Write  $a - \frac{a}{b}$  as a single fraction (1)
- d) Simplify  $(2\sqrt{3})^3$  (1)
- e) Evaluate  $27^{-\frac{2}{3}}$  (1)
- f) Subtract  $x^3 - x^2 + 1$  from  $2x^2 - 1$  (2)

### Question 2

- a) Express 0.34 as a fraction in simplest form (2)
- b) Rationalise the denominator of  $\frac{\sqrt{2}}{4 - \sqrt{2}}$  and simplify. (2)
- c) Simplify  $\sqrt{\frac{a^2 b^{20}}{b^4}}$  (2)
- d) State the domain and range of  $y = x^2 + 1$  (2)

### Question 3

Factorise fully:

- a)  $xy + x^2 + y + x$  (2)
- b)  $y^3 + 8$  (2)
- c)  $3a^2 - 7a - 6$  (2)
- 21

#### Question 4

a) Simplify  $\frac{5x-4y}{25x^2-16y^2}$  (2)

b) If  $f(x) = 1 - x^3$  find the value of (i)  $f(2)$  (1)

(ii)  $x$ , if  $f(x) = 65$  (2)

c) Find the  $y$  intercept of the parabola  $y = x^2 + x + 6$  (1)

#### Question 5

a) Solve the following:

(i)  $\frac{x-4}{3} + 2 = \frac{3x}{5}$  (2)

(ii)  $2x^2 - 4x = 0$  (2)

(iii)  $|x-1| > 4$  (2)

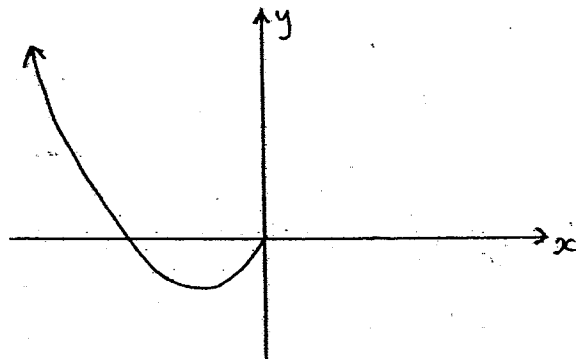
b) State the domain and range for  $y = \sqrt{9-x^2}$  (2)

#### Question 6

a) Solve  $|x+1| = 5-3x$  (3)

b) (i) Write the algebraic condition for  $y = f(x)$  to be an odd function (1)

(ii) You are given that the curve below represents an odd function



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

Copy or trace the diagram onto your answer sheet.

Complete the graph given that it is an odd function.

(1)

- c) Find the simultaneous solution to  $2x + y = 1$  and  $xy + 3 = 0$  (3)

**Question 7**

- a) Sketch the following on separate number planes. Show all important features and intercepts.

Use a ruler for the axes and be neat.

(i)  $y = x^2 - 4$  (2)

(ii)  $y = x + 4$  (2)

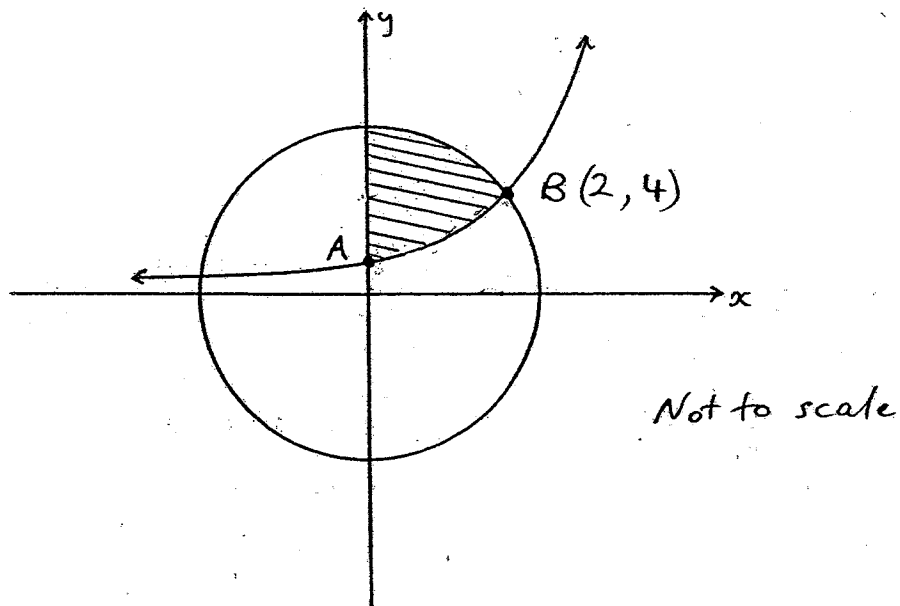
(iii)  $y = |x + 2|$  (2)

- b) Use the graphs above, or otherwise, to solve  $x + 4 = |x + 2|$  (1)

**Question 8**

A circle, centre the origin, and an exponential function of the form  $y = a^x$  are shown. A & B lie on the curves as shown. B has co-ordinates (2, 4).

Find



- (i) the coordinates of A (1)  
 (ii) the equation of the circle (2)  
 (iii) the equation of the exponential function (1)  
 (iv) Give the three inequations which combine to define the shaded region shown. (3)

# 2 Unit Year 11 Solutions. 2005 (May)

Q1

a) 211.76

b) 7900

c)  $\frac{ab-a}{b}$

d)  $24\sqrt{3}$

e)  $\frac{1}{9} (0 \cdot i)$

f)  $(2x^2 - 1) - (x^3 - x^2 + 1)$   
 $= 2x^2 - 1 - x^3 + x^2 - 1$   
 $= 3x^2 - x^3 - 2$

Q2

a)  $x = 0.3444\dots$

$10x = 3.444\dots$

$100x = 34.444\dots$

$x = 31/90$

$\therefore 0.3\dot{4} = 31/90$

b)  $\frac{\sqrt{2}}{4-\sqrt{2}} \times \frac{4+\sqrt{2}}{4+\sqrt{2}}$

$= \frac{4\sqrt{2} + 2}{16 - 2}$

$= \frac{2(2\sqrt{2} + 1)}{14}$

$= \frac{2\sqrt{2} + 1}{7}$

c)  $= \sqrt{a^2 b^{16}} = ab^8$

d) D = All real x

R =  $y \geq 1$

Q3

a.  $x(y+x) + 1(y+x)$   
 $= (y+x)(x+1)$

b.  $(y+2)(y^2 - 2y + 4)$

c.  $(3a+2)(a-3)$

Q4.

a)  $\frac{5x-4y}{(5x-4y)(5x+4y)}$   
 $= \frac{1}{5x+4y}$

b) i.  $1 - 8 = -7$

ii.  $65 = 1 - x^3$

$x^3 = -64$

$\therefore x = -4$

c.  $y = 6$

Q5

a) i.  $\frac{x-4}{3} + 2 = \frac{3x}{5}$

$\times 15$

$5(x-4) + 30 = 9x$

$5x - 20 + 30 = 9x$

$-4x = -10$

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

ii.  $2x(x-2) = 0$

$x = 0, x = 2$

iii.  $|x-1| > 4$

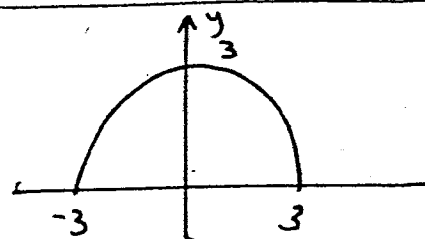
$x-1 > 4$  or  $-x+1 > 4$

$x > 5$   $-x > 3$

$x < -3$

$\therefore x < -3$  or  $x > 5$

b)



D:  $-3 \leq x \leq 3$

R:  $0 \leq y \leq 3$

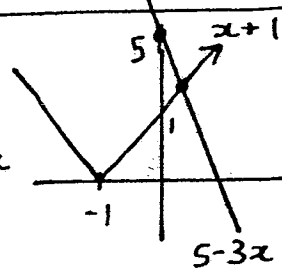
Q6 a)

Sol<sup>n</sup>

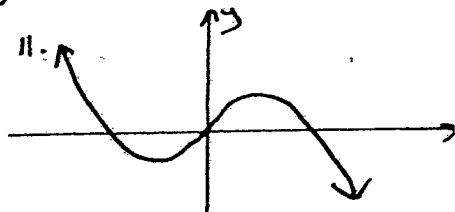
$x+1 = 5-3x$

$4x = 4$

$\therefore x = 1$



b) i.  $f(-x) = -f(x)$



c)  $2x + y = 1$

$y = 1 - 2x$

$\therefore x(1-2x) + 3 = 0$

$x - 2x^2 + 3 = 0$

$2x^2 - x - 3 = 0$

$(2x-3)(x+1) = 0$

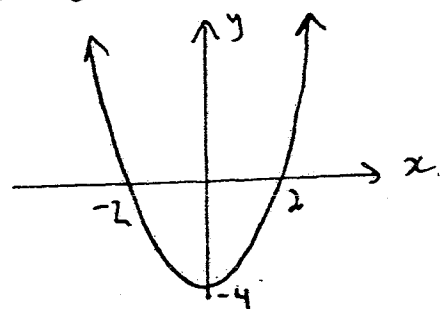
$x = 3/2, x = -1$

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

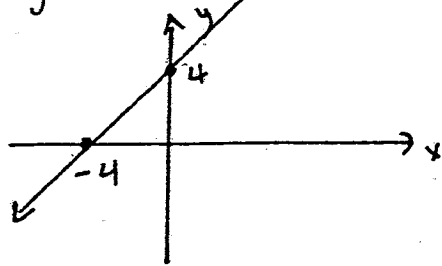
and when  $x = -1, y = 3$

7.

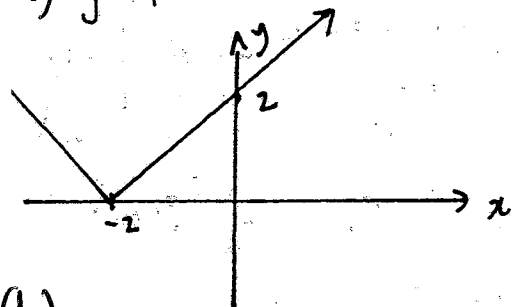
a) i)  $y = x^2 - 4$



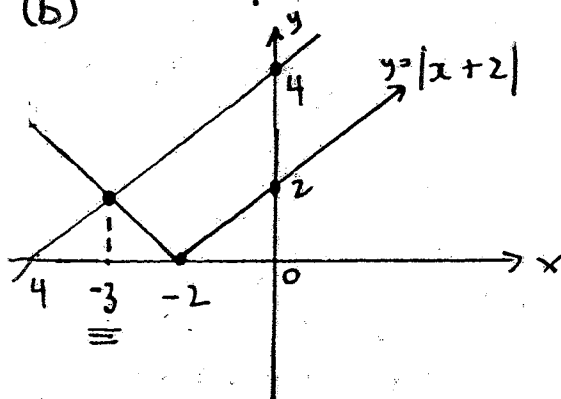
(ii)  $y = x + 4$



(iii)  $y = |x + 2|$



(b)



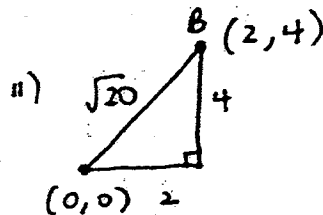
$$-x - 2 = x + 4$$

$$-2x = 6$$

$$\therefore x = -3$$

Q8

i)  $A(0, 1)$



$$x^2 + y^2 = r^2$$

$$\therefore x^2 + y^2 = 20$$

iii.  $y = a^x$  sub in  $(2, 4)$

$$4 = a^2$$

$$\therefore a = 2$$

$$\text{equation} \Rightarrow y = 2^x$$

iv.  $x \geq 0$

$$x^2 + y^2 \leq 20$$

$$y \geq 2^x$$