

SYDNEY TECHNICAL HIGH SCHOOL



MATHEMATICS

Year 11

2 Unit

April 2007

Common Test

Time Allowed: 70 mins

Name :

Teacher :

Instructions:

- Begin each question on a new page
- Marks shown are approximate and may be varied
- Show necessary working
- Full marks may not be awarded if working is poorly set out or difficult to read
- Write all answers in simplest form

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	TOTAL
/8	/8	/8	/9	/8	/8	/8	/8	/65

Question 1

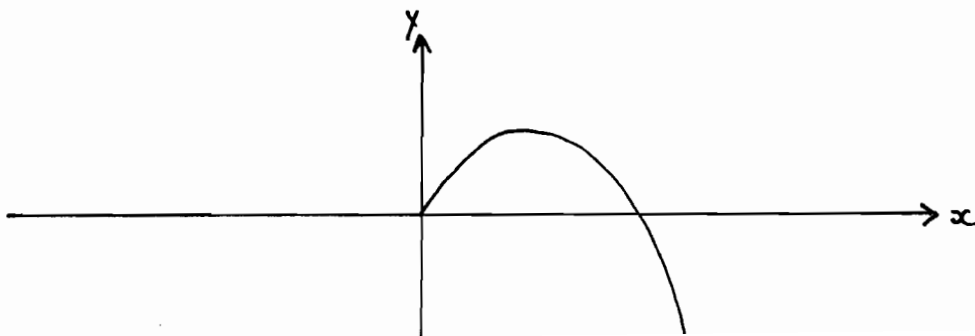
- a) Evaluate $\frac{2}{(1.11)^5 - 1}$ correct to 3 decimal places 2
- b) Express 68272 correct to 2 significant figures 1
- c) Write $\frac{x}{y} - 2$ as a single fraction 1
- d) Given that the surface area of an open cylinder is given by
 $A = 2\pi rh + \pi r^2$
find the value of h when $A = 250$ and $r = 6$ correct to 1 decimal place 2
- e) Subtract $3x^2 - 1$ from $x^3 - 2x^2 + 3$ 2

Question 2

- a) Find the exact value of $x^2 - 4x$ if $x = 4\sqrt{3}$ 2
- b) Rationalise the denominator of $\frac{\sqrt{3}}{6 - \sqrt{3}}$ 2
- c) Simplify $\sqrt{\frac{a^3 b^7}{ab^3}}$ 2
- d) State the range of the function $y = x^2 - 1$ 1
- e) The diagram shows part of a function $y = f(x)$ 1

Copy this diagram onto your answer sheet.

Complete the graph of $y = f(x)$ given that it is an odd function.



Question 3

a) Factorise fully

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

(ii) $3a^2 + 2a - 8$ 2

(iii) $xy + 6x - y - 6$ 2

b) Simplify $\frac{a^3 + 1}{a^2 - a + 1}$ 2

Question 4

a) Solve the following

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

(ii) $4x^2 - 4x + 1 = 0$ 2

(iii) $|x + 2| \leq 2$ 2

(iv) $|x - 1| = 3x - 1$ 3

Question 5

a) Sketch the following functions on separate number planes. Use a ruler to draw the axes. Label any important points.

(i) $y = \frac{2}{x}$ 1

(ii) $y = 3 - x$ 2

(iii) $y = 9 - x^2$ 2

b) Consider the function $y = \sqrt{16 - x^2}$

(i) Explain why the domain of this function is restricted 1

(ii) Find this domain 1

(iii) Sketch the function on a number plane 1

Question 6

a) (i) Solve simultaneously:

2

$$2x + 3y = 4$$

$$3x + 6y = 2$$

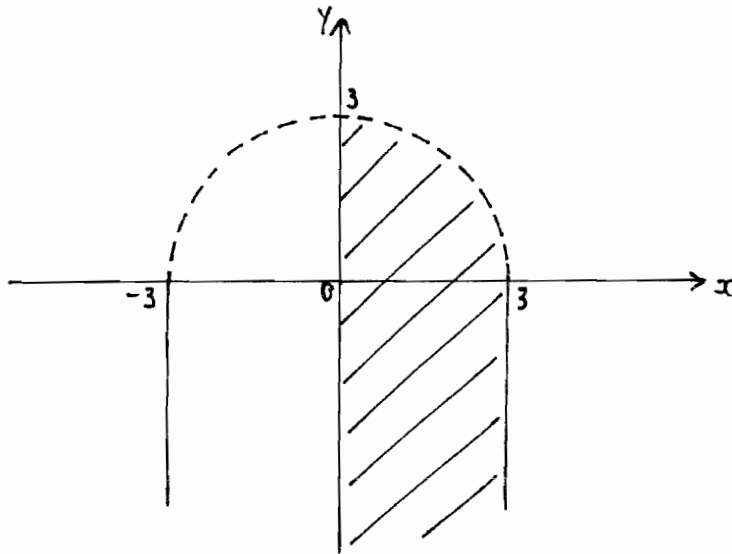
(ii) What does this solution represent in relation to the graphs of

$$2x + 3y = 4 \text{ and } 3x + 6y = 2 ?$$

1

b) State the two inequalities which represent the shaded region below:

2



c) Express $0.\dot{3}\dot{6}$ as a simple fraction.

3

Question 7

a) Find the values of a and b if $a + \sqrt{b} = 5 + 3\sqrt{6}$

2

b) Simplify fully $\sqrt{98} \times \sqrt{48}$

2

c) Solve $(x - 2)^2 = 3$ leaving your answer as a surd.

2

d) The function $f(x)$ is defined as

2

$$f(x) = \begin{cases} x^2 + 1 & \text{if } x > 3 \\ 3x & \text{if } -2 \leq x \leq 3 \\ 2 & \text{if } x < -2 \end{cases}$$

Find $f(-3) + f(4) - f(3)$

Question 8

a) Simplify $\frac{2}{x-y} + \frac{y}{x^2-y^2}$ 2

b) Simplify $f(x) + f(-x)$ if $f(x)$ is an odd function 1

c) Determine if the following function is odd, even or neither. 2

Show all working. $f(x) = \frac{x^2+1}{x^2-1}$

d) (i) Expand $(x - \frac{1}{x})^2$ 1

(ii) If $x - \frac{1}{x} = 3$, find the value of $x^2 + \frac{1}{x^2}$ without solving for x 2

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

b) $f(-x) = \frac{(-x)^2+1}{(-x)^2-1} = \frac{x^2+1}{x^2-1} = f(x)$ ∴ even

c)

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Student's Name/N°:

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Question 1

a) $\frac{2.919}{2}$

b) $\frac{68000}{6.8 \times 10^4}$ or
①

c) $\frac{x}{y} - 2$
 $\frac{x}{y} - \frac{2y}{y}$
 $= \frac{x - 2y}{y}$ ①

d) $A = 2\pi rh + \pi r^2$
 $250 = 2 \times \pi \times 6 \times h + \pi \times 6^2$ ①
 $h = 3.6$ ①

e) $x^3 - 2x^2 + 3 - (3x^2 - 1)$ ①
 $x^3 - 5x^2 + 4$ ①

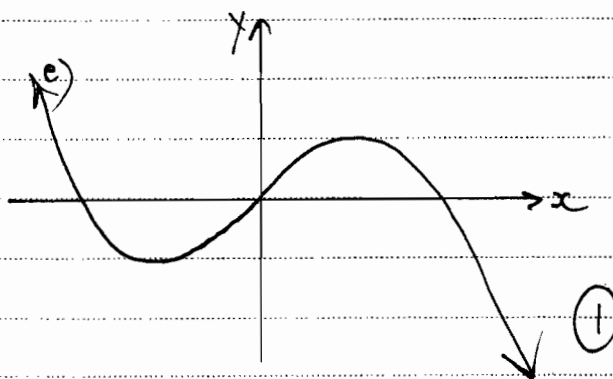
Question 2

a) $x^2 - 4x$
 $(4\sqrt{3})^2 - 4(4\sqrt{3})$ ①
 $16 \times 3 - 16\sqrt{3}$
 $48 - 16\sqrt{3}$ ①

b) $\frac{\sqrt{3}}{6-\sqrt{3}} \times \frac{6+\sqrt{3}}{6+\sqrt{3}}$
 $\frac{6\sqrt{3} + 3}{33}$ ①
 $\frac{2\sqrt{3} + 1}{11}$ ①

c) $\frac{a^3 b^7}{\sqrt{a b^3}}$
 $\sqrt{a^2 b^4}$ ①
 $= ab^2$ ①

d) $y = x^2 - 1$

Range: All real $y \geq -1$ ①

Question 3

a) i) $x^4 - x^2$
 $x^2(x^2 - 1)$ ①
 $x^2(x-1)(x+1)$ ①

ii) $3a^2 + 2a - 8$
 $(3a-4)(a+2)$ ②

iii) $xy + 6x - y - 6$
 $x(y+6) - 1(y+6)$ ①
 $(x-1)(y+6)$ ①

b) $a^3 + 1 = (a+1)(a^2 - a + 1)$ ①
 $= (a+1)$ ①

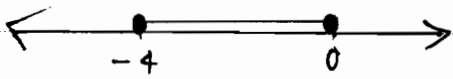
Teacher's Name:

Student's Name/N°:

Question 4

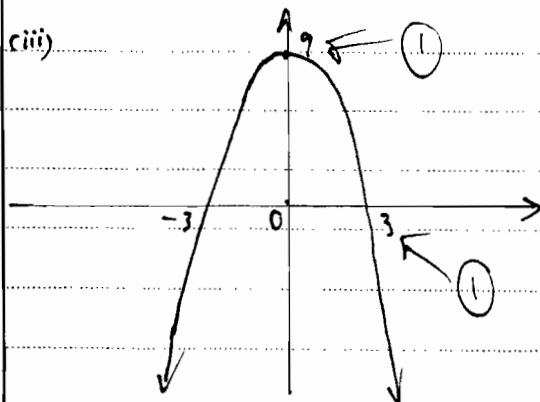
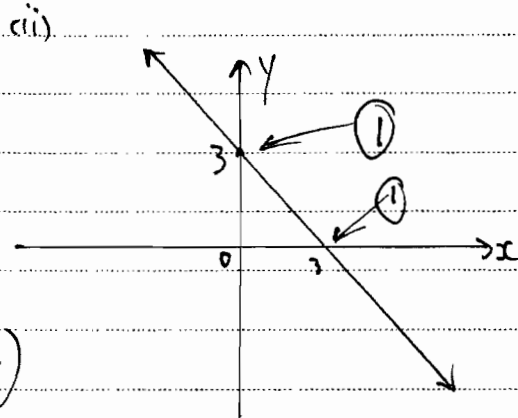
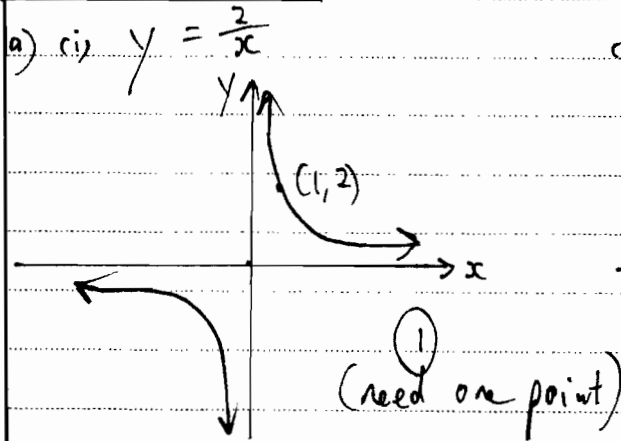
a) (i) $\frac{x-5}{4} + 3 = \frac{5x}{3}$
 $3(x-5) + 36 = 20x$
 $3x - 15 + 36 = 20x$ ①
 $21 = 17x$
 $x = \frac{21}{17}$ ①

(ii) $4x^2 - 4x + 1 = 0$
 $(2x-1)^2 = 0$ ①
 $x = \frac{1}{2}$ ①

(iii) $|x+2| \leq 2$
 $x+2 \leq 2$ or $x+2 \geq -2$ ①
 $x \leq 0$ or $x \geq -4$

 $-4 \leq x \leq 0$ ①

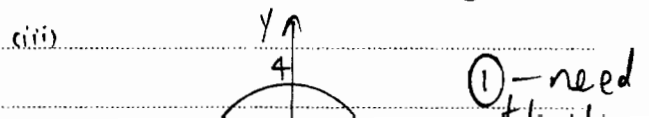
(iv) $|x-1| = 3x-1$
 $x-1 = 3x-1$ or $x-1 = -(3x-1)$
 $0 = 2x$ or $x-1 = -3x+1$
 $x = 0$ or $4x = 2$
 $x = \frac{1}{2}$ ①
 Check! $x = \frac{1}{2}$ only ①

Question 5



b) (i) You can't $\sqrt{\text{a negative}}$ ①

(ii) $16 - x^2 \geq 0$
 $(4-x)(4+x) \geq 0$
 $-4 \leq x \leq 4$ ①



Teacher's Name: _____

Student's Name/N^o: _____Question 6

a) (i) $2x + 3y = 4$ ①

$3x + 6y = 2$ ②

$2 \times \text{①} - \text{②}$

$4x + 6y = 8 -$

$3x + 6y = 2$

$x = 6$

$\therefore 2 \times 6 + 3y = 4$

$3y = -8$

$x = 6, y = -\frac{8}{3}$

①

①

(ii) Point of intersection

①

b) $x \geq 0$ and $-$ ①

$y < \sqrt{9-x^2}$

①

c) Let $x = 0.3666\dots$

$\therefore 10x = 3.6666\dots$ ①

$\therefore 9x = 3.3$

$x = \frac{3.3}{9}$

$= \frac{33}{90}$ ①

$x = \frac{11}{30}$ ①

①

①

Question 7

a) $a + \sqrt{b} = 5 + 3\sqrt{6}$

$a + \sqrt{b} = 5 + \sqrt{54}$

$\therefore a = 5, b = 54$

①

①

b) $\sqrt{98} \times \sqrt{48}$

$= 7\sqrt{2} \times 4\sqrt{3}$ ①

$= 28\sqrt{6}$

①

c) $(x-2)^2 = 3$

$x-2 = \pm\sqrt{3}$

$x = 2 \pm \sqrt{3}$

①

d) $f(-3) + f(4) - f(3)$

$2 + 4^2 + 1 - 3 \times 3$ ①

$2 + 17 - 9$

$= 10$

①

Question 8

$$a) \frac{2}{x-y} + \frac{y}{x^2-y^2}$$

$$\frac{2}{x-y} + \frac{y}{(x-y)(x+y)}$$

$$\frac{2(x+y)}{(x-y)(x+y)} + \frac{y}{(x-y)(x+y)} \quad (1)$$

$$= \frac{2x+3y}{(x-y)(x+y)} \quad \text{or} \quad \frac{2x+3y}{x^2-y^2} \quad (1)$$

$$b) f(x) + f(-x)$$

$$= 0 \quad (1)$$

$$c) f(x) = \frac{x^2+1}{x^2-1}$$

odd if $f(-x) = -f(x)$

$$\frac{(-x)^2+1}{(-x)^2-1} = -\left(\frac{x^2+1}{x^2-1}\right)$$

$$\frac{x^2+1}{x^2-1} \neq -\frac{x^2+1}{x^2-1}$$

\therefore Not odd

even if $f(x) = f(-x)$

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

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

\therefore Even

$$d) \text{ (i) } \left(x - \frac{1}{x}\right)^2$$

$$= x^2 - 1 - 1 + \frac{1}{x^2}$$

$$= x^2 + \frac{1}{x^2} - 2$$

(1)

$$\text{ (ii) } \left(x - \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} - 2$$

$$\therefore x^2 + \frac{1}{x^2} = \left(x - \frac{1}{x}\right)^2 + 2 \quad (1)$$

$$= 3^2 + 2$$

$$x^2 + \frac{1}{x^2} = 11$$

(1)