

SYDNEY TECHNICAL HIGH SCHOOL



MATHEMATICS

Year 11

2 Unit

Task 1
2013

Common Test

Time Allowed: 70 mins

Name : _____

Teachers Name : _____

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	/8	/8	/8	/8	/8	/64

Question 1

8 marks

a) Arrange in ascending order:

$$3^{\frac{1}{2}}, \quad 2^{\frac{5}{6}}, \quad \left(\frac{3}{11}\right)^{-\frac{1}{3}} \quad 1$$

b) Calculate $\frac{9.62 \times 10^{-4}}{3.67 \times 10^{-3} \times 2.67 \times 10^2}$ giving your answer correct to 2 significant figures 1

c) Write $\frac{x}{y} - 2$ as a single fraction 1

d) Given $s = \frac{n}{2}[2a + (n - 1)d]$ find s when n=16, a=5, d=4 1

e) Gold, a very soft metal, can be hammered into sheets of thickness 1.02×10^{-4} mm.
How many such sheets are needed to make a pile 1 cm thick? 1

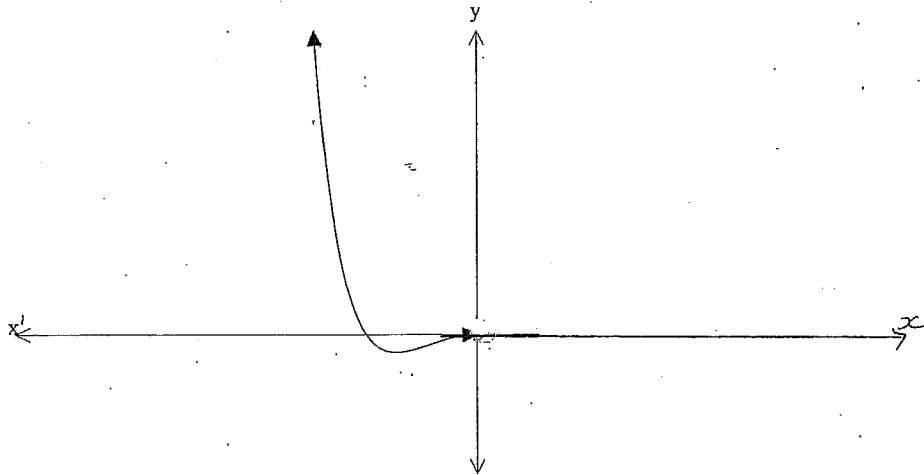
f) Express $0.2\bar{9}8$ as a fraction in lowest terms. 2

g) Rewrite $2(x^2 - 1)^{-\frac{1}{2}}$ as an expression with no negative or fractional indices 1

Question 2

8 marks

- a) Simplify $\frac{1}{\sqrt{3} + \sqrt{x}} + \frac{1}{\sqrt{3} - \sqrt{x}}$ 2
- b) Subtract $3x^2 - 1$ from $x^3 - 2x^2 + 3$ 1
- c) The area of a circle is found using the formula $A = \pi r^2$. If the area of a particular circle is 45cm^2 , find the radius correct to 1 decimal place 1
- d) The diagram shows part of a function $y = f(x)$



Copy this diagram onto your answer sheet.

Complete the graph of $y = f(x)$ given that it is an even function. 1

e) Simplify $\sqrt{\frac{a^3 b^7}{ab^3}}$ 2

f) Simplify $a^7 \times 5a^{-3} \div 15a^{-4}$ 1

Question 3

8 marks

Factorise fully

- a) $x^4 - x^2$ 2
- b) $3a^2 + 2a - 8$ 2
- c) $x^2 - 12xy + 20y^2$ 2
- d) $16x^4 - 2x$ 2

Question 4

8 marks

a) (i) Solve the following equations simultaneously:

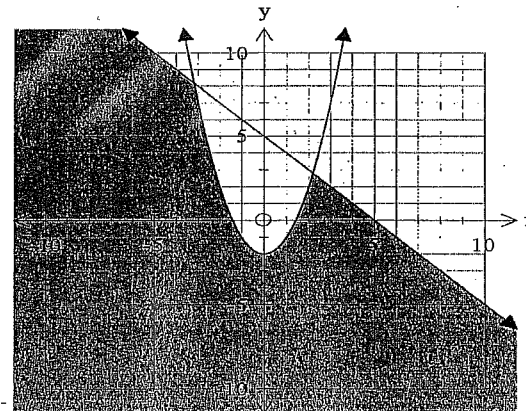
$$\begin{cases} x^2 + y^2 = 21 \\ x + y = 3 \end{cases} \quad 2$$

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

$$x^2 + y^2 = 21 \text{ and } x + y = 3 ? \quad 1$$

b) Using the process of completing the square, solve the following leaving your answer in surd form: $x^2 + 4x = 1$ 2

c) State the two inequalities which represent the shaded region below: 3



Question 5

8 marks

Solve the following

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

b) $4x^2 - 4x + 1 = 0$ 2

c) $|x+2| \leq 2$ 2

d) $|2x+6| = 3x-1$ 2

Question 6

8 marks

a) Sketch the following graphs on separate number planes. Use a ruler to draw all straight lines. Label any important points.

i. $y = |x-2|$ 2

ii. $x^2 + y^2 = 4$ 2

iii. $y = (x+1)^2 + 2$ 2

b) From a visual perspective, which of the previous questions are functions?
(Do not provide a formal proof). 2

Question 7

8 marks

a) Simplify fully $\sqrt{98} \times \sqrt{48}$ 2

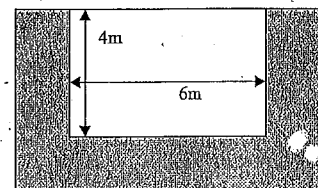
b) Simplify $\frac{a^3+1}{a^2-a+1}$ 1

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

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

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

d) A rectangular garden bed; 6m long and 4m wide has a path of uniform width around three sides as shown



If the area of the path is 25.5m^2 , use a quadratic equation to find the width of the path.

2

Question 8

8 marks

a) For the function $y = \frac{x^2 + 3x}{x + 3}$

i. State any discontinuities

1

ii. State the domain and range of the function

2

iii. Sketch the graph of the function, showing all important points.

3

b) Find $f(x)$ for all x given that $f(x-1) = x^2 - 1$

2

End of Paper

YEAR 11 Mathematics Task 1 (2013)

$\sqrt{3} = 1.732 \dots$
 $2^{5/6} = 1.78179 \dots$
 $3^{1/11} = 1.54202 \dots$
 $1^{1/3}, \sqrt{3}, 2^{5/6}$
 9.8×10^{-4}
 $\frac{x-2y}{y}$
 $= \frac{1}{2} [10 + (15)4]$
 $= 560$
 $1.02 \times 10^{-4} \times 10.00$
 $= 98039.21$
 $= 98040 \text{ sheets}$
 $1000n = 298.989898 \dots$
 $10n = 2.9898 \dots$
 $990n = 296$
 $n = \frac{148}{495}$
 $= \frac{2}{\sqrt{x^2-1}}$

Q2

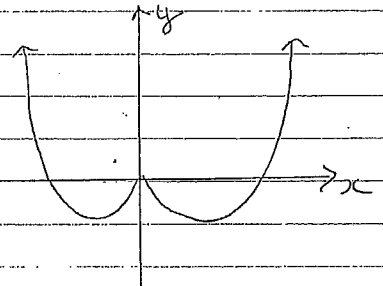
$$\frac{1}{\sqrt{3+\sqrt{x}}} + \frac{1}{\sqrt{3-\sqrt{x}}}$$

$$= \frac{\sqrt{3-\sqrt{x}} + \sqrt{3+\sqrt{x}}}{(\sqrt{3+\sqrt{x}})(\sqrt{3-\sqrt{x}})}$$

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

(b) $x^3 - 2x^2 + 3$
 $- \frac{(3x^2 - 1)}{x^3 - 5x^2 + 4}$

(c) $\pi r^2 = 45$
 $r = \sqrt{\frac{45}{\pi}}$
 $= 3.784 \dots$
 $= 3.8$

(d) 

(e) $= ab^2$

(f) $= \frac{a^8}{3}$

Q3
 (a) $x^2(x-1)(x+1)$
 (b) $(a+2)(3a-4)$
 (c) $(x-2y)(x-10y)$
 (d) $2x((2x)^3 - 1^3)$
 $= (2x)(2x-1)(4x^2+2x+1)$

Q4
 (a) (i) $x^2 + y^2 = 21$ — ①
 $x+y = 3$ — ②
 $y = 3-x$ sub into ①
 $x^2 + (3-x)^2 = 21$
 $x^2 + 9 - 6x + x^2 = 21$
 $2x^2 - 6x + 12 = 0$
 $2(x^2 - 3x - 6) = 0$
 $x = \frac{3 \pm \sqrt{33}}{2}$
 $x = \frac{3+\sqrt{33}}{2}$ $y = \frac{6 - (3+\sqrt{33})}{2}$
 $= \frac{3-\sqrt{33}}{2}$
 $x = \frac{3-\sqrt{33}}{2}$ $y = \frac{3+\sqrt{33}}{2}$

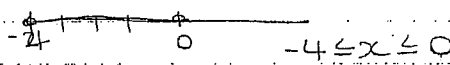
(ii) where graphs intersect.

(b) $x^2 + 4x = 1$
 $(x+2)^2 = 1+4$
 $x+2 = \pm\sqrt{5}$
 $x = \sqrt{5}-2, -\sqrt{5}-2$

(c) $y \leq -x+5$
 $y \leq x^2-2$

Q5
 (a) $\frac{x-5}{4} + 3 = \frac{5x}{3}$
 $x-5+12 = \frac{5x}{3}$
 $\frac{x+7}{4} = \frac{5x}{3}$
 $3x+21 = 20x$
 $21 = 17x$
 $x = 21/17$

(c) $|x+2| \leq 2$
 $x+2 \leq 2$ $-x-2 \leq 2$
 $x \leq 0$ $-x \leq 4$
 $x \geq -4$
 $-4 \leq x \leq 0$



Q5

(d) $|2x+6| = 3x-1$

$2x+6 = 3x-1$
 $7 = x$

check

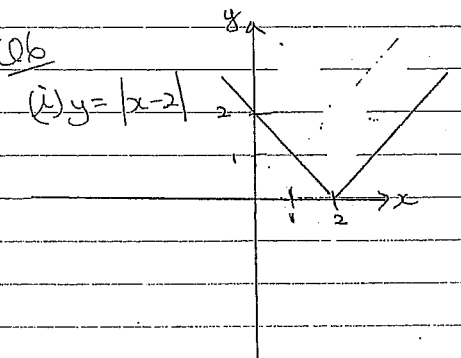
LHS: 20
RHS: 20

$-2x-6 = 3x-1$
 $-5 = 5x$
 $x = -1$

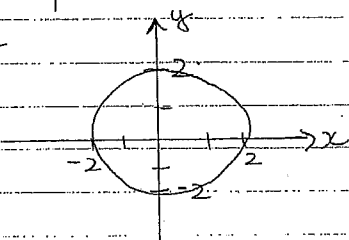
check

LHS: 4
RHS: -4

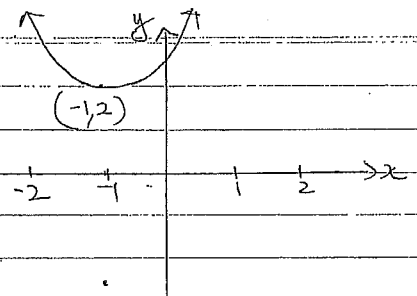
\therefore only soln $x=7$



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



(iii)



(b)

(i) + (iii)

Q7

$\frac{\sqrt{98} \times \sqrt{48}}{\sqrt{4704}} = \frac{\sqrt{4704}}{\sqrt{4704}}$
 $= \sqrt{16 \times 294}$
 $= 4\sqrt{49 \times 6}$
 $= 28\sqrt{6}$

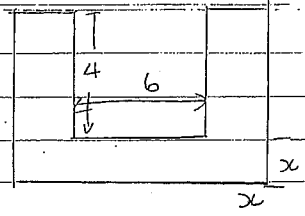
(b) $\frac{a^3+1}{a^2-a+1} = \frac{(a+1)(a^2-a+1)}{a^2-a+1}$

$= a+1$

(c) $f(3) = 2$
 $f(4) = 17$
 $f(9) = 9$

$2 + 17 - 9 = 10$

Q7
(a)



$A = 2(4+6)x + 6x$
 $255 = 2x^2 + 14x$

$4x^2 + 28x - 51 = 0$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
 $= \frac{-28 \pm \sqrt{1600}}{8}$
 $= \frac{-28 \pm 40}{8}$
 $= 3/2, x \neq -68/8$

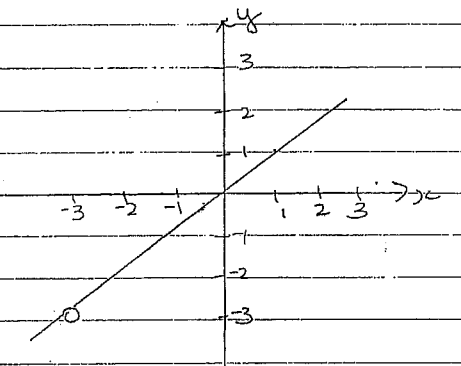
\therefore width = $3/2$ m

Q8

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

(i) $x = -3$

(ii) domain $x = x \in \mathbb{R} \ x \neq -3$
range $y = y \in \mathbb{R} \ y \neq -3$



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

$f(x) = x^2 + 2x$