

Name: ..

..... Maths Class:

SYDNEY TECHNICAL HIGH SCHOOL



Year 11 Mathematics

Preliminary Course

Assessment 1

May, 2017

Time allowed: 90 minutes

General Instructions:

- Marks for each question are indicated on the question.
- Approved calculators may be used
- All necessary working should be shown
- Full marks may not be awarded for careless work or illegible writing
- ***Begin each question on a new page***
- Write using black or blue pen
- All answers are to be in the writing booklet provided
- A Reference Sheet is attached to the last page of this booklet. You may detach it.

Section I Multiple Choice
Questions 1-5
5 Marks

Section II Questions 6-13
64 Marks

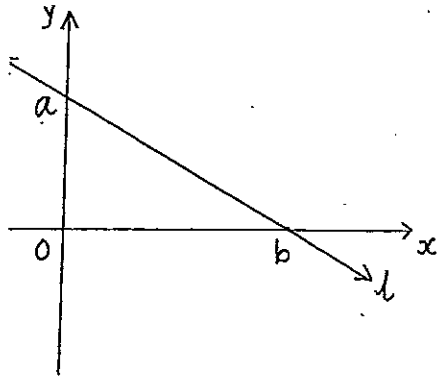
SECTION I

Marks

If $a\sqrt{b} = \sqrt{x}$ then $x =$

- A. ab B. ab^2 C. a^2b D. a^2b^2

1

What is the equation of the line l ?

- A. $y = \frac{a}{b}x + a$
 B. $y = \frac{a}{b}x + b$
 C. $y = -\frac{a}{b}x + a$
 D. $y = -\frac{a}{b}x + b$

1

The equation of the axis of symmetry of the graph of $y = 2x^2 - 8x + 5$ is

- A. $x = 2$ B. $x = 4$ C. $x = -2$ D. $x = -4$

1

Make G the subject of the formula $E = 1 - \sqrt{\frac{G}{R}}$.

- A. $G = R(1 + E)^2$ B. $G = R(1 + E^2)$
 C. $G = R(1 - E^2)$ D. $G = R(1 - E)^2$

1

Another expression for $(-2)^{2n}$ is

- A. $-(2^{2n})$ B. 4^n C. -4^n D. 2^{n^2}

1

SECTION II

Question 6 Start a new page.

Marks

(a) Evaluate $\frac{1}{(1.05)^{11} - 1}$ correct to 3 decimal places

1

(b) Solve $|1 - 2x| = 5$

2

(c) Write $1 - \frac{a}{b}$ as a single fraction

1

(d) The area of a trapezium is given by

2

$$A = \frac{1}{2}h(a + b)$$

Find the value of a given $A = 624$, $h = 26$ and $b = 18$

(e) Subtract $x^3 - x^2 + 1$ from $2x^2 - 1$

2

Question 7 Start a new page.

(a) Find the exact value of $x^2 + 3x$ if $x = 2\sqrt{5}$

2

(b) Rationalise the denominator of $\frac{\sqrt{2}}{4 - \sqrt{2}}$

2

(c) Simplify $\sqrt{\frac{a^2b^6}{a^4b^2}}$

2

(d) Express 2 950 000 in scientific notation correct to 2 significant figures.

2

Question 8 Start a new page.

(a) Factorise fully

i. $xy + 8x + y + 8$

2

ii. $x^3 - x$

2

iii. $3a^2 - 7a - 6$

2

(b) Simplify $\frac{3x - 4y}{9x^2 - 16y^2}$

2

Question 9Start a new page.**Marks**

(a) Solve the following

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

ii. $2x^2 - 5x + 3 = 0$ 2

iii. $|x - 1| > 4$ 2

(b) Expand and simplify $(a + b)(a - b) - a(a - 2b)$ 2**Question 10**Start a new page.

(a) Sketch the following functions

Note: Use a separate number plane for each part.

Each sketch must be neat and labelled.

Use a ruler to draw the axes.

Label any important points.

i. $y = \frac{4}{x}$ 2

ii. $y = 4 - x$ 1

iii. $y = 4 - x^2$ 2

(b) Find the exact solutions of $x(2x + 1) = 2$ 3

Question 11

Start a new page.

Marks

(a) Factorise

i. $y^3 - 8$

ii. $9 - (x + y)^2$

1

1/2

(b) Consider the function $y = \sqrt{5 - x}$

State: i. its natural domain

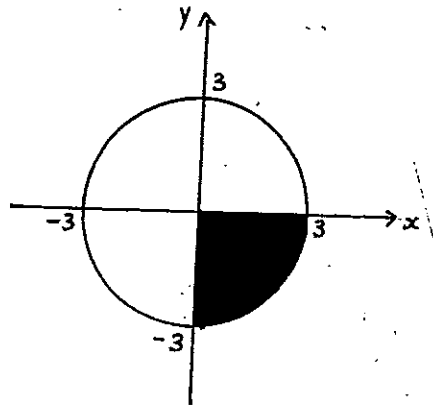
ii. its range

1

1

(c) State the three inequalities which combine to define the shaded region shown.

3



Question 12Start a new page.

Mark:

- (a) i. Solve simultaneously
- $$x + y = 4$$
- $$xy = 4$$
- ii. What is the significance of this solution in relation to the graphs of $x + y = 4$ and $xy = 4$?
- (b) Solve $|x - 1| = 2x - 1$
- (c) For what value/s of x is $x \times x < x + x$?

Question 13Start a new page.

- (a) Consider the function $y = 1 + \frac{1}{x}$
- i. For what value of x is the function undefined? 1
- ii. Find the x intercept 1
- iii. What is the equation of the horizontal asymptote? 1
- iv. Hence sketch the curve 2
- (b) i. Expand $\left(x + \frac{1}{x}\right)^2$ 1
- ii. If $x + \frac{1}{x} = 4$, find the value of $x^2 + \frac{1}{x^2}$ without solving for x . 2

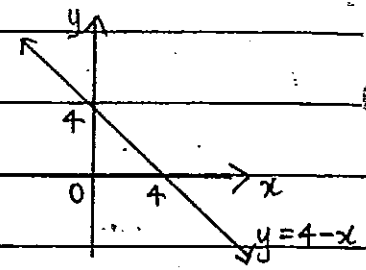


SECTION I	(e) $2x^2 - 1 - (x^3 - x^2 + 1)$
1. $a\sqrt{b} = \sqrt{x}$	$= 2x^2 - 1 - x^3 + x^2 - 1$
$(a\sqrt{b})^2 = \sqrt{x}^2$	$= -x^3 + 3x^2 - 2$
$a^2b = x$ (C)	
2. $y = mx + b$ where $m = -\frac{a}{b}$	Question 7
$\therefore y = -\frac{a}{b}x + a$ (C)	(a) $(2\sqrt{5})^2 + 3 \times 2\sqrt{5}$
3. $y = 2x^2 - 8x + 5$	$= 4 \times 5 + 6\sqrt{5}$
$x = \frac{-b}{2a}$	$= 20 + 6\sqrt{5}$
$x = \frac{-(-8)}{2 \times 2}$	(b) $\frac{\sqrt{2}}{4 - \sqrt{2}} \times \frac{4 + \sqrt{2}}{4 + \sqrt{2}}$
$\therefore x = 2$ (A)	$= \frac{4\sqrt{2} + 2}{16 - 2}$
4. $E = 1 - \sqrt{\frac{G}{R}}$	$= \frac{4\sqrt{2} + 2}{14}$
$\sqrt{\frac{G}{R}} = 1 - E$	$= \frac{4\sqrt{2} + 2}{14}$
$\frac{G}{R} = (1 - E)^2$	$= \frac{2\sqrt{2} + 1}{7}$
$\therefore G = R(1 - E)^2$ (D)	(c) $\sqrt{\frac{a^2b^6}{a^4b^2}} = \sqrt{\frac{b^4}{a^2}}$
5. $(-2)^{2n} = 4^n$ (B)	$= \frac{b^2}{a}$
SECTION II	(d) 3.0×10^6
Question 6	Question 8
(a) <u>1.408</u>	(a) i. $xy + 8x + y + 8$
(b) $ 1 - 2x = 5$	$= x(y + 8) + 1(y + 8)$
$1 - 2x = 5$ $1 - 2x = -5$	$= (x + 1)(y + 8)$
$2x = -4$ $6 = 2x$	ii. $x(x^2 - 1)$
$\therefore x = -2, 3$	$= x(x + 1)(x - 1)$
(c) $\frac{b - a}{b}$	iii. $3a^2 - 7a - 6$
(d) $624 = \frac{1}{2} \times 26(a + 18)$	$3a \times -2$
$48 = a + 18$	$= (3a + 2)(a - 3)$
$\therefore a = 30$	



(b) $\frac{3x-4y}{(3x+4y)(3x-4y)} = \frac{1}{3x+4y}$

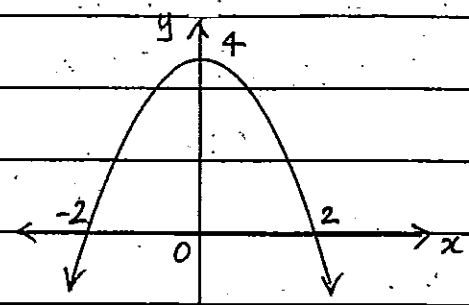
ii.



Question 9

(a) i. $15 \times \frac{x-4}{3} + 2 \times 15 = \frac{3x}{5} \times 15$
 $5(x-4) + 30 = 9x$
 $5x - 20 + 30 = 9x$
 $10 = 4x$
 $\therefore x = 2.5$

iii.



ii. $2x^2 - 5x + 3 = 0$

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

$\therefore x = \frac{3}{2}, 1$

iii. $|x-1| > 4$

$x-1 > 4 \quad -(x-1) > 4$

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

$x < -3$

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

(b) $x(2x+1) = 2$

$2x^2 + x = 2$

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

$x = \frac{-1 \pm \sqrt{1^2 - 4 \times 2 \times -2}}{2 \times 2}$

$\therefore x = \frac{-1 \pm \sqrt{17}}{4}$

(b) $(a+b)(a-b) - a(a-2b)$
 $= a^2 - b^2 - a^2 + 2ab$
 $= 2ab - b^2$

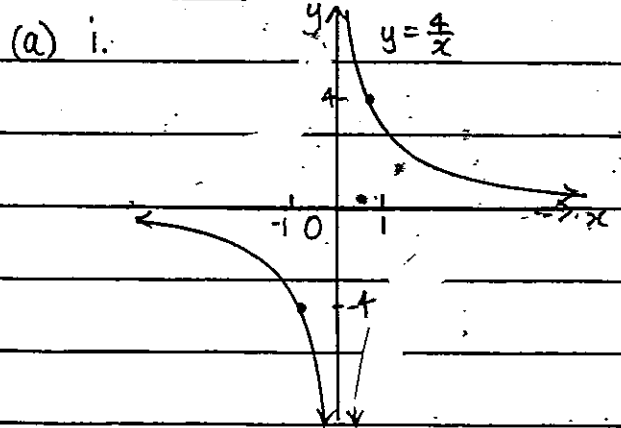
Question 11

(a) i. $(y-2)(y^2+2y+4)$

ii. $[3+(x+y)][3-(x+y)]$

$= (3+x+y)(3-x-y)$

Question 10



(b) i. $5-x \geq 0$

$x \leq 5$

ii. $y \geq 0$

(c) $x^2 + y^2 \leq 9$

$x \geq 0$

$y \leq 0$



Question 12

(a) i. $x+y=4$ -①

$$xy=4$$
 -②

$$x=4-y$$
 -③

sub ③ into ②

$$y(4-y)=4$$

$$4y-y^2=4$$

$$y^2-4y+4=0$$

$$(y-2)^2=0$$

$$y=2$$

sub $y=2$ into ③

$$x=4-2$$

$$x=2$$

$$\therefore \underline{x=2, y=2}$$

ii. The graphs intersect at $(2,2)$.

(b) $|x-1|=2x-1$

$$x-1=2x-1 \quad - (x-1)=2x-1$$

$$0=x \quad -x+1=2x-1$$

$$2=3x$$

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

check solutions!

$$\therefore \underline{x=\frac{2}{3}} \text{ only}$$

(c) $x \times x < x+x$

$$x^2 < 2x$$

$$x^2-2x < 0$$

$$x(x-2) < 0$$

$$\frac{0}{0} \quad \frac{0}{2} \quad \therefore \underline{\underline{0 < x < 2}}$$

Question 13

(a) i. $x=0$

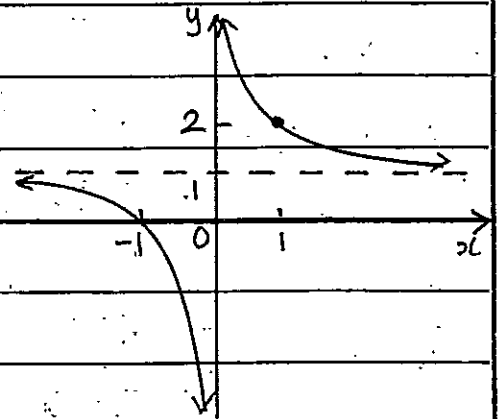
ii. $0=1+\frac{1}{x}$

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

$$\therefore \underline{x=-1}$$

iii. $\underline{y=1}$

iv.



(b) i. $(x+\frac{1}{x})^2$

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

ii. from i.

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

$$= 4^2 - 2$$

$$= \underline{\underline{14}}$$