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

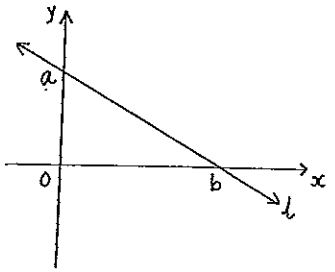
SECTION I

Mark

1. If $a\sqrt{b} = \sqrt{x}$ then $x =$ 1

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

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. $y = -\frac{a}{b}x + b$

3. The equation of the axis of symmetry of the graph of $y = 2x^2 - 8x + 5$ is 1

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

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

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

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

5. Another expression for $(-2)^{2n}$ is 1

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

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 9 Start a new page. Mark

(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. Mark

(a) Factorise

i. $y^3 - 8$ 1

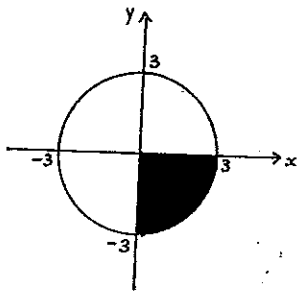
ii. $9 - (x + y)^2$ 2

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

State: i. its natural domain 1

ii. its range 1

(c) State the three inequalities which combine to define the shaded region shown. 3



Question 12 Start a new page. Mark

(a) i. Solve simultaneously 3

$x + y = 4$

$xy = 4$

ii. What is the significance of this solution in relation to the graphs of $x + y = 4$ and $xy = 4$? 1

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

(c) For what value/s of x is $x \times x < x + x$? 2

Question 13 Start 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

END OF TEST

YEAR 11 – ASSESSMENT 1 – 2017

SECTION I

1. $a\sqrt{b} = \sqrt{x}$

$(a\sqrt{b})^2 = \sqrt{x}^2$

$a^2 b = x$ ©

2. $y = mx + b$ where $m = -\frac{a}{b}$

$\therefore y = -\frac{a}{b}x + a$ ©

3. $y = 2x^2 - 8x + 5$

$x = \frac{-b}{2a}$

$x = \frac{-(-8)}{2\times 2}$

$\therefore x = 2$ Ⓐ

4. $E = 1 - \sqrt{\frac{G}{R}}$

$\sqrt{\frac{G}{R}} = 1 - E$

$\frac{G}{R} = (1-E)^2$

$\therefore G = R(1-E)^2$ Ⓓ

5. $(-2)^{2n} = 4^n$ Ⓑ

SECTION II

Question 6

(a) 1·408

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

$1-2x = 5 \quad 1-2x = -5$

$2x = -4 \quad 6 = 2x$

$\therefore x = -2, 3$

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

(d) $624 = \frac{1}{2} \times 26\,(a+18)$

$48 = a + 18$

$\therefore a = 30$

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

$= 2x^2 - 1 - x^3 + x^2 - 1$

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

Question 7

(a) $(2\sqrt{5})^2 + 3x\,2\sqrt{5}$

$= 4\times 5 + 6\sqrt{5}$

$= 20 + 6\sqrt{5}$

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

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

$= \frac{4\sqrt{2}+2}{14}$

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

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

$= \frac{b^2}{a}$

(d) 3.0×10^6

Question 8

(a) i. $xy + 8x + y + 8$

$= x(y+8) + 1(y+8)$

$= (x+1)(y+8)$

ii. $x(x^2-1)$

$= x(x+1)(x-1)$

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

$3a \times a \quad 2 \times -3$

$= (3a+2)(a-3)$

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

Question 9

(a) i. $15 \times \frac{x-4}{3} + 2\times 15 = \frac{3x}{5} \times 15$

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

$5x - 20 + 30 = 9x$

$10 = 4x$

$\therefore x = 2.5$

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

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

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

iii. $|x-1| > 4$

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

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

$x < -3$

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

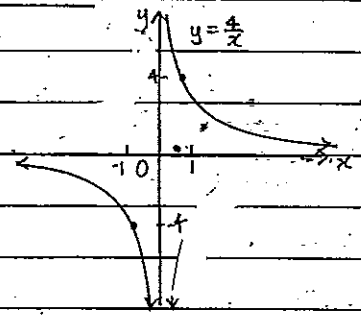
(b) $(a+b)(a-b) - a(a-2b)$

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

$= 2ab - b^2$

Question 10

(a) i.



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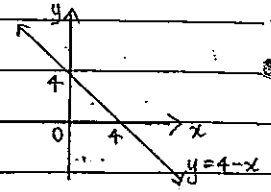
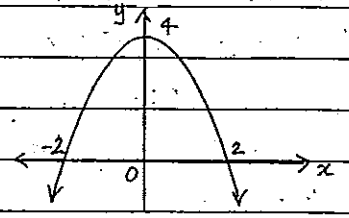


iii.



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

$2x^2 + x = 2$

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

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

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

Question 11

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

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

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

(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

$x=4-2$

$x=2$

$\therefore x=2, y=2$

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!

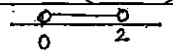
$\therefore x=\frac{2}{3}$ only

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

$x^2 < 2x$

$x^2-2x < 0$

$x(x-2) < 0$



$\therefore 0<x<2$

Question 13

(a) i. $x=0$

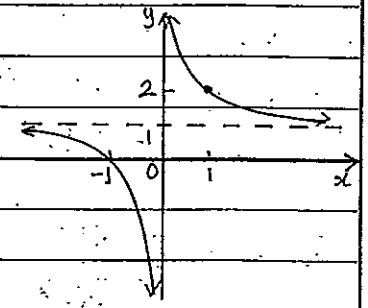
ii. $0=1+\frac{1}{x}$

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

$\therefore x=-1$

iii. $y=1$

iv.



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

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

ii. from i.

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

$=4^2-2$

$=14$