

Name: Maths Class:

SYDNEY TECHNICAL HIGH SCHOOL



Year 11 Mathematics

Assessment 1

May, 2016

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 BOSTES reference sheet is provided

Section 1 Multiple Choice
Questions 1-5
5 Marks

Section II Questions 6-13
64 Marks

SECTION 1

Use multiple choice answer sheet

1. $(x+2)$ is a factor of which expression

(A) $x^3 - 8$

(B) $x^3 + 8$

(C) $x^2 + 4$

(D) $x^2 - 4x + 4$

2. $\left(\frac{2a}{3b}\right)^{-5} = ?$

(A) $\frac{2a^5}{3b^5}$

(B) $\frac{3b^5}{2a^5}$

(C) $\frac{243b^5}{32a^5}$

(D) $\frac{1}{243b^5}$

3. Express $\frac{\sqrt{5}}{1+\sqrt{2}}$ in the form of $\sqrt{a} - \sqrt{b}$ where a and b are rational numbers.

A $\sqrt{10} - \sqrt{5}$

B $\sqrt{5} - \sqrt{10}$

C $(\sqrt{10} - \sqrt{5})/3$

D $(\sqrt{5} - \sqrt{10})/3$

4. What is the domain of the function $f(x) = \sqrt{2x+4}$?

(A) All real x such that $x \leq -2$

(B) All real x such that $x > -2$

(C) All real x such that $x < -2$

(D) All real x such that $x \geq -2$

5. A circle has the equation $x^2 - 8x + y^2 - 1 = 0$. It has a radius of:

(A) 17

(B) 4

(C) 1

(D) $\sqrt{17}$

Section II

(64 marks)

Question 6 (8 marks)

Mark

- a) Evaluate
- | | | |
|-----|---------------|---|
| i) | $ -6 + -7 $ | 1 |
| ii) | $ -6 - -7 $ | 1 |
- b) Evaluate $(\sqrt{6} - 1)^{-1}$ correct to 3 decimal places
- 1
- c) Factorise fully
- | | | |
|------|-------------------|---|
| i) | $5 - 14x - 3x^2$ | 1 |
| ii) | $16 - x^2$ | 1 |
| iii) | $ab + ac - b - c$ | 1 |
| iv) | $a^4 - ab^3$ | 2 |

Question 7 (8 marks)

(Start a new page)

- a) Write $\frac{x+1}{2} - \frac{x-4}{5}$ as a single fraction
- 2
- b) Simplify fully by factorising first
- $$\frac{3x^2 - 19x - 14}{9x^2 - 4}$$
- 2
- c) Solve for x
- $$\frac{x}{7} - 4 = \frac{x}{2} + 11$$
- 2
- d) Solve $4k^2 - 6k - 1 = 0$ and leave your answer in simplest exact form
- 2

Question 8 (8 marks) (Start a new page)

Mark

- a) Solve the following pair of simultaneous equations

$$4x - 5y = 2$$

$$x + 10y = 41$$

2

- b) Expand and simplify $(4 - 3\sqrt{2})^2$

2

- c) Simplify $\frac{3}{\sqrt{5} - 2} + \frac{2}{\sqrt{5} + 2}$

by expressing with the lowest common denominator

2

- d) Solve $2x^2 - x - 6 \leq 0$

2

Question 9 (8 marks) (Start a new page)

- a) Solve $|7x - 3| = 11$

2

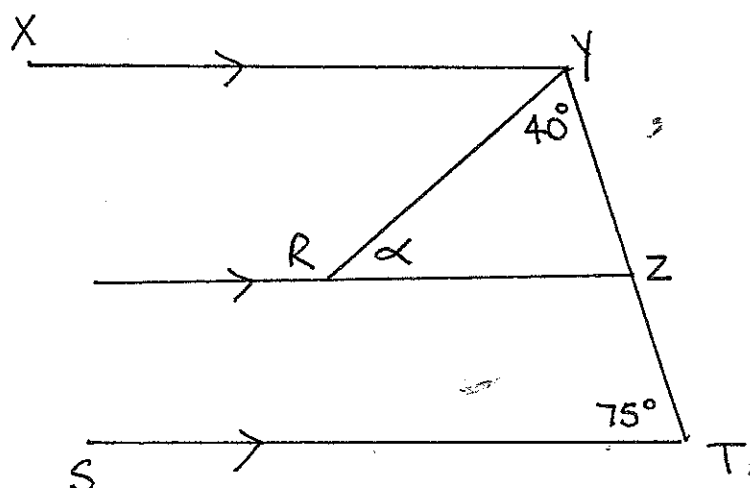
- b) Solve and sketch your solution on a number line

$$|x + 2| < 4$$

3

- c) Find α in diagram below giving reasons for your answer

3



Question 10 (8 Marks)

(Start a new page)

Mark

- a) On separate axes sketch the following functions. Show all relevant information on your sketch. State the domain and range for each function.

i) $y = 9 - x^2$

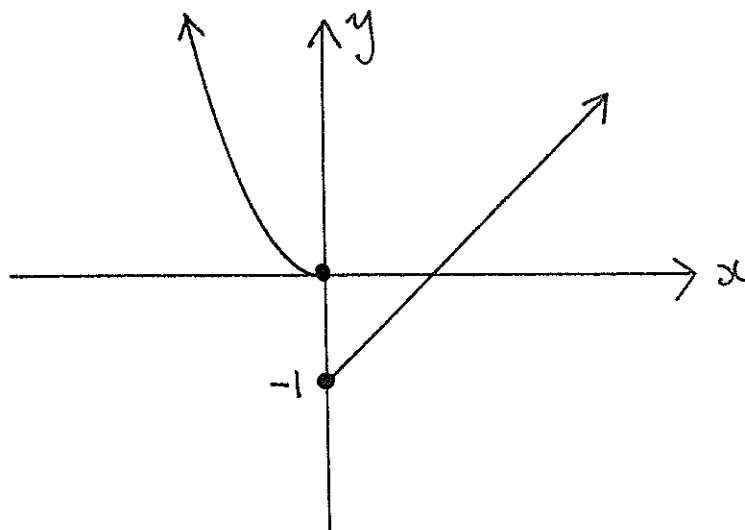
3

ii) $y = -2^x$

3

- b) Explain why the graph below is NOT a function

1



- c) If $G(x) = (2x - 1)(x + 3)$, for what values of x is $G(x) = 0$

1

Question 11 (8 Marks)

(Start a new page)

Mark

a) Explain why $y = x^3$ is an odd function

1

b) i) Sketch the function below

$$f(x) = \begin{cases} x, & \text{if } x > 0 \\ -2, & \text{if } x = 0 \\ x + 1, & \text{if } x < 0 \end{cases}$$

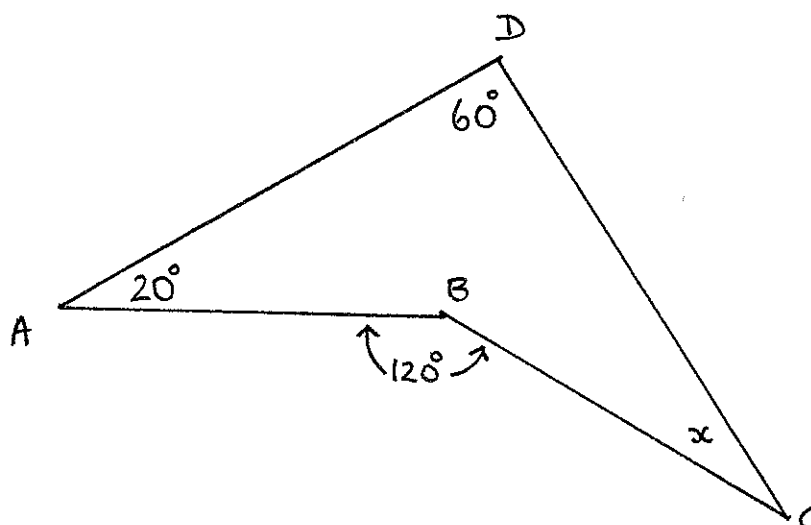
3

ii) Hence find $f(2) + f(0) + f(-2)$

1

c) Find x and give a reason for your answer

2



d) What is the size of each interior angle in a regular octagon?

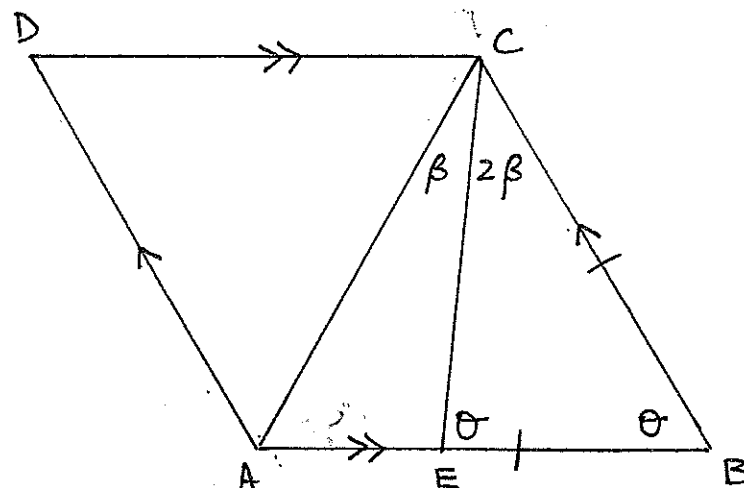
1

Question 12 (8 Marks)

(Start a new page)

Mark

- a) From the diagram below, ABCD is a rhombus



- i) $\angle C \hat{A} B = 3\beta$, write a reason for this

- ii) $\theta = 4\beta$, write a reason for this

- iii) Find the value of θ and β

$\beta + 4\beta = 180^\circ$
 $5\beta = 180^\circ$
 $\beta = 36^\circ$
 $\theta = 4\beta = 144^\circ$

- b) Solve and check the solutions for

$$|x - 1| = 2x + 1$$

$x - 1 = 2x + 1 \Rightarrow x = -2$
 $x - 1 = -(2x + 1) \Rightarrow x = 0$

- c) Given $F(x) = x^2 - 3$ and $g(x) = 4 - x$

find $F(g(1))$

2

Question 13 (8 Marks) (Start a new page)

- a) For the function $y = \frac{1}{x-1}$
- i) State the equation of the vertical asymptote 1
 - ii) Write the domain of the function 1
 - iii) Sketch the function. Show where it cuts the y axis 1
 - iv) State the range of the function 1
- b) Write $\frac{x+8}{x^{-1} + 8^{-1}}$ in simplest form without using negative indices 2
- c) Solve $|x+4| + |2-x| = 12$ 2

SOLUTIONS

SECTION 1

1/ B 2/ C 3/ A 4/ D 5/ D

SECTION 11

QUESTION 6(a)(i) 13 (ii) -1

(b) $\frac{\sqrt{6+1}}{5} = 0.686$

(c) (i) $-(3x-1)(x+5)$ or $(x+5)(1-3x)$

(ii) $(4+x)(4-x)$

(iii) $(b+c)(a-1)$

(iv) $a(a^3-b^3) = a(a+b)(a^2+ab+b^2)$

QUESTION 7

(a) $\frac{5x+5-2x+8}{10} = \frac{3x+13}{10}$

(b) $\frac{(3x+2)(x-7)}{(3x+2)(3x-2)} = \frac{x-7}{3x-2}$

(c) $2x - 56 = 7x + 154$
 $-210 = 5x$
 $x = -42$

(d) ~~8~~

$k = \frac{6 \pm \sqrt{36+16}}{2}$
 $= 3 \pm \sqrt{13}$

QUESTION 8:

(a) $4x - 5y = 2$ (1)
 $7x + 10y = 4$ (2)

(1) $\times 2 + (2)$ $9x = 45$
 $x = 5$
 $\therefore y = 3.6$

(b) $34 - 24\sqrt{2}$

(c) $\frac{3\sqrt{5}+6+2\sqrt{5}-4}{31}$
 $= \frac{5\sqrt{5}+2}{31}$
 $= 5\sqrt{5}+2$

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

$-3/2 \leq x \leq 2$

QUESTION 9:

(a) $7x - 3 = 11$ or $7x - 3 = -11$
 $x = 2$ or $x = -8/7$

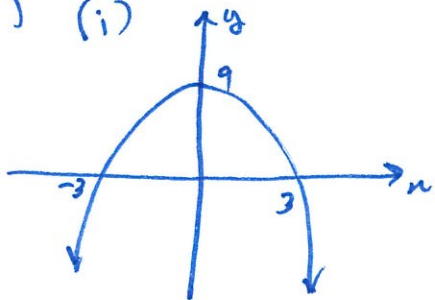


$-6 \leq x < 2$

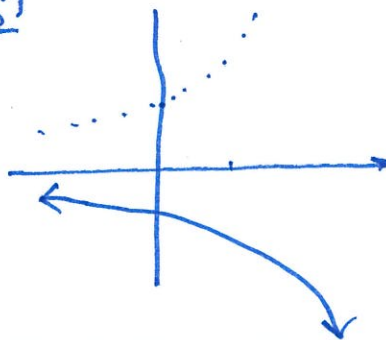
(c) $\angle XYZ = 105^\circ$ (co-interior angles, $xy \parallel sr$)
 $\therefore \angle xZR = 65^\circ$
 $\therefore \angle yRZ = 15^\circ$
 (alternate angles, $xy \parallel RZ$)

QUESTION 10:

(a) (i)



(ii)



(b) (i) DISCONTINUITY at $x = 0$

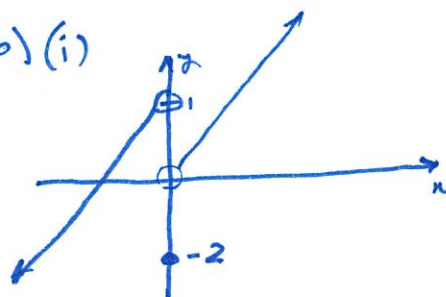
(c) $G(x) = (2x-1)(x+3) = 0$
 $\Rightarrow x = 1/2$ or $x = -3$.

QUESTION 11:

(a) $f(a) = a^3$
 $f(-a) = (-a)^3$
 $= -a^3$
 $= -f(a)$

\therefore ODD

(b) (i)



(ii) $f(2) + f(1) + f(-2)$
 $= 2 + (-2) + (-1)$
 $= -1$

(c) Reflex $\angle ABC = 240^\circ$
 $\therefore x = 40^\circ$ (angle sum of quad.)

(d) Angle sum $= (8-2) \times 180$
 $= 1080^\circ$
 \therefore Each angle $= 145^\circ$

QUESTION 12:

(a)(i) Since $\triangle ABC$ is isosceles, its base angles are equal.

$\therefore \angle CAB = 3\beta$

(ii) $\theta = 3\beta + \beta$ as $\angle E$ is the exterior angle of $\triangle ACE$

(iii) $4\beta + 4\beta + 2\beta = 180$ (angle sum of $\triangle CEB$)
 $\beta = 18^\circ$
 $\theta = 72^\circ$

(b)

$x-1 = 2x+1$ or $x-1 = -2x-1$
 $x = -2$ or $3x = 0$
 $x = 0$

checking: X

✓

$\therefore x = 0$

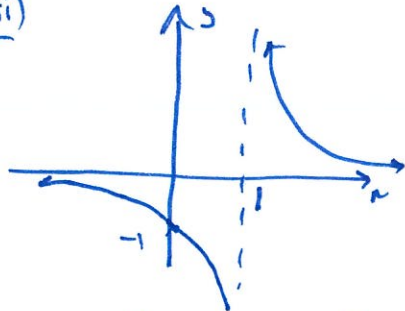
QUESTION 13:

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

(i) Vertical Asymptote is $x=1$

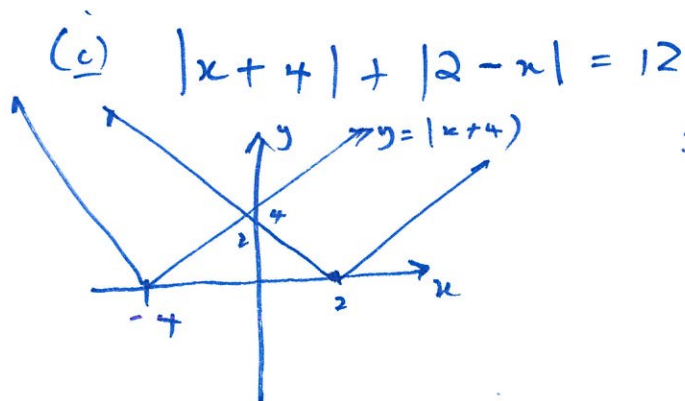
(ii) Domain: $\{x: x \neq 1, \text{ all other } x\}$

(iii)



(iv) R: all $y, y \neq 0$

(b)
$$\frac{x+8}{\frac{1}{x} + \frac{1}{8}} = \frac{8x(x+8)}{8+x}$$
$$= 8x$$



So $x+4+2-x=12$
NO SOLN

or, $x+4-2+x=12$
 $x=5$

or, $-x-4+2-x=12$
 $x=-7$

or, $-x-4-2+x=12$
NO SOLN

$\therefore x=5$ or $x=-7$