School of Isolated and Distance Education
MATHEMATICS METHODS Year 11
Test 2 2023 Calculator Free

Time allowed for this section 25 minutes

Marks allocation: 22 marks

* COMMENTS

PERMISSIBLE ITEMS

Standard Items: pens, pencils, pencil sharpener, highlighter, eraser, ruler

Special Items: **Formulae Sheet**

STANDARD FORMULAE SHEET IS PROVIDED
NO OTHER ITEMS MAY BE TAKEN INTO THE EXAMINATION ROOM

INSTRUCTIONS FOR CANDIDATES

Show all your working clearly. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated marks. **For any question or part question worth more than two marks, valid working or justification is required to receive full marks.** If you repeat any question, ensure that you cancel the answer you do not wish to have marked.

All work should be done in the space provided. Should you need extra working area you may use the blank page at the end.

Student's name: SOLUTIONS

SIDE Teacher's name: _____

SUPERVISOR'S DECLARATION

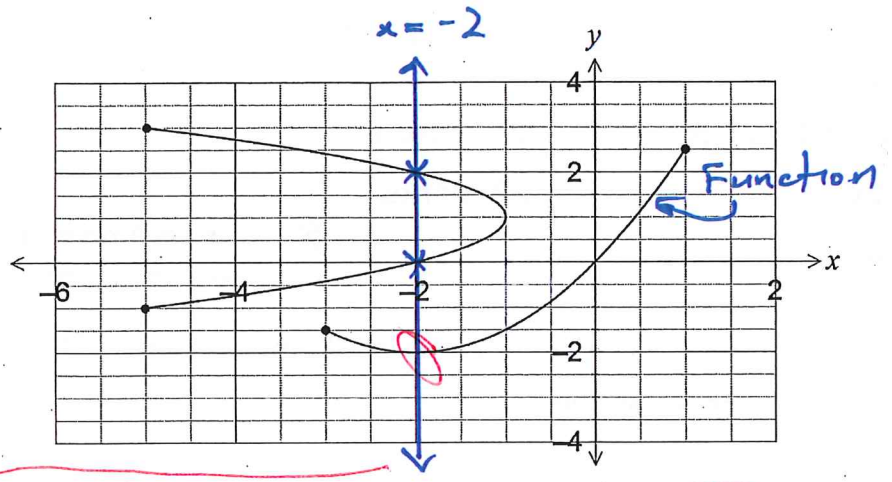
I declare that this test paper has been completed without assistance by the student named above. The time and resource restrictions have been observed and the student has not accessed notes, reference books, a computer, a mobile phone or other electronic device. I understand that this paper will not be counted for assessment if these conditions have not been met.

Supervisor's name: _____

Supervisor's signature: _____ **Date:** _____

Question 1 [2, 2 = 4 marks]

A function and another relation have been graphed on the axes below.



(a) Draw the line $x = -2$ on the graph and explain how it can be used to identify the relation that is not a function.

NOT a parabola.

$x = -2$ cuts one relation at more than one point.

This identifies it is NOT a function.

✓

Answer must identify the non-function.

(b) State the domain and range of the function.

Domain : $-3 \leq x \leq 1$ ✓

Range : $-2 \leq y \leq 2.5$.

least value for y ✓

Some confuse < and >

Question 2 [1, 1, 1, 2, 3 = 8 marks]

(a) A quadratic function is given by $f(x) = (x+1)^2 - 4$. For this function determine

i. the coordinates of the y – intercept.

$f(0) = 1^2 - 4$

$= -3$ ✓ $\therefore$ $(0, -3)$

ii. the equation of the line of symmetry.

$x = -1$ ✓

Some confuse 'coordinates' and 'equation'.

iii. the coordinates of the turning point.

$(-1, -4)$ ✓

* Deduct 1 mark if not given as co-ordinates when asked.

(b) Another quadratic function is given by $y = 2 + 1.75x - 0.25x^2$. Determine

I. the equation of the line of symmetry

$x = \frac{-1.75}{2(-0.25)}$ ✓

$= 1.75 \div 0.5$

$x = 3.5$ ✓

You will never have to do complex calculations in Calc-free.

II. the coordinates of the x intercepts.

$f(x) = 0 = -0.25(x^2 - 7x - 8)$ ✓

ie $0 = -0.25(x-8)(x+1)$

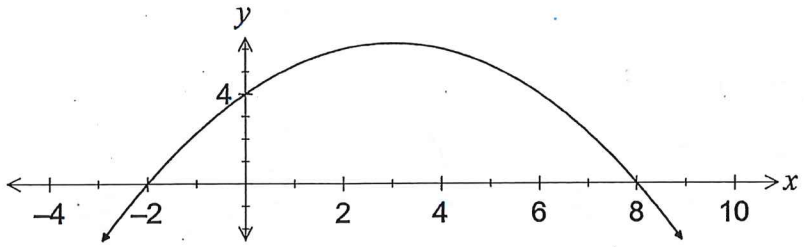
$x = 8$ or $x = -1$ ✓ ✓

$\therefore$ $(8, 0)$ and $(-1, 0)$

P.S. This is not considered 'complex' in Methods.

Question 3 [4 marks]

(a) Part of the graph of $y = ax^2 + bx + 4$ is shown below.



Determine the values of the coefficients a and b.

INTERCEPTS given so...

$y = a(x+2)(x-8)$ ✓

$= a(x^2 - 6x - 16)$

$= ax^2 - 6ax - 16a$ ✓

*Or other correct strategy.

So, $-16a = 4$

$a = -\frac{1}{4}$ ✓

and $b = -6a$

$= -6 \times -\frac{1}{4}$

$b = 1.5$ ✓

Question 4 [4, 2 = 6 marks]

Consider the points $A(6, -10)$ and $B(-2, -2)$.

(a) Determine the equation of the line through A that is perpendicular to AB.

$m_1 m_2 = -1$

$m_{AB} = \frac{-2 - -10}{-2 - 6}$ ✓

$= \frac{8}{-8}$

$= -1$

$\therefore m = 1$ ✓

So $-10 = 6 + b$ FT.

$b = -16$ ✓

$\therefore y = x - 16$ ✓

Ex 4D

(b) Explain whether the line through A and B is parallel to the line with equation $3x + 3y + 5 = 0$.

$3y = -3x - 5$

$y = -1x - \frac{5}{3}$ ✓

As both have a gradient of -1, YES. ✓

Linear function needs review!

School of Isolated and Distance Education
MATHEMATICS METHODS Year 11

Test 2 2023 Calculator Assumed

Time allowed for this section 25 minutes

Marks allocation: 23 marks

COMMENTS

PERMISSIBLE ITEMS

Standard Items: pens, pencils, pencil sharpener, highlighter, eraser, ruler

Special Items: **Formulae Sheet, CAS calculator, up to two other calculators, ONE A4 page of notes**

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Question 5 [2, 2, 3 = 7 marks]

MUST use the formula!

(a) Demonstrate use of the quadratic formula to solve $4x^2 - 16x + 15 = 0$.

$$x = \frac{16 \pm \sqrt{(-16)^2 - 4(4)(15)}}{2(4)} \checkmark$$

$x = 2.5$ and $x = 1.5$ ✓

** See formula sheet.

(b) Use the method of completing the square to solve the following equations.

i. $x^2 - 6x + 7 = 0$

must use. solve!!

$(x-3)^2 - 9 + 7 = 0$

$(x-3)^2 = 2$ ✓

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

$x = \sqrt{2} + 3$ → ✓ ← $x = -\sqrt{2} + 3$

$[\approx 4.41]$ $[\approx 1.59]$

ii. $2x^2 + 6x - 4.5 = 0$

$2(x^2 + 3x - 2.25) = 0$ ✓

$2((x+1.5)^2 - 1.5^2 - 2.25) = 0$

$2(x+1.5)^2 - 9 = 0$ ✓

$x + 1.5 = \sqrt{4.5}$ or $x + 1.5 = -\sqrt{4.5}$

$x = \sqrt{4.5} - 1.5$ — ✓ — $x = -\sqrt{4.5} - 1.5$

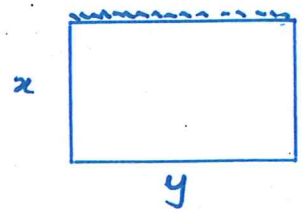
$[\approx 0.621]$ $[\approx -3.621]$

Button-pushing!

MUST show reasoning. Answer alone will get 2 or 3 marks only.

Question 6 [5 marks]

A gardener has 40m of fencing to enclose a rectangular garden plot, where one side is an existing brick wall. Determine the dimensions of the garden to maximise the area.



$2x + y = 40 \Rightarrow y = 40 - 2x$

$A = xy$

$= x(40 - 2x)$

Quadratic with x-intercepts (0,0) and (20,0)

So TP lies on $x = 10$

$\therefore y = 20$

concave down, TP a maximum.

$\therefore$ Dimensions for max area are $x = 10\text{m}$ and $y = 20\text{m}$

- understanding ✓
- correct dimensions ✓
- valid argument ✓✓✓
  - ↳ related to concepts from the course.

This is virtually the same question as Ex5C #12 and the introductory problem for Lesson 1 in Week 9.

Question 7 [3, 3 = 6 marks)

Write the equation of the quadratic function that;

a) intercepts the x-axis at 2 and -3 and passes through the point (1,4)

$y = a(x-2)(x+3)$ ✓

For (1,4): $4 = a(1-2)(1+3)$

$4 = -4a$

$\therefore a = -1$ ✓

$\therefore y = -(x-2)(x+3)$ $[-x^2 - x + 6]$ ✓

b) has a turning point of (-3,5) and passes through the point (-4,8)

$y = a(x+3)^2 + 5$ ✓

For (8,-4): $8 = a(-4+3)^2 + 5$ ✓

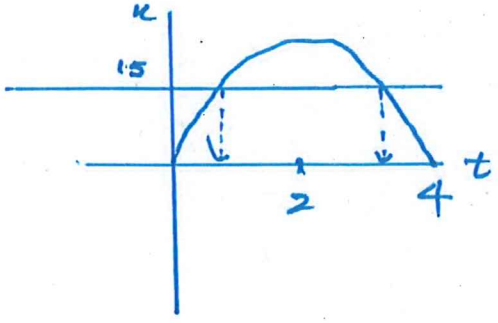
$3 = a$ ✓

$\therefore y = 3(x+3)^2 + 5$

Question 8 [2, 3 = 5 marks]

A stone is thrown vertically upwards from a point A. The height x metres of the stone above A after t seconds is given by $x = 20t - 5t^2$.

(a) Determine the maximum height the stone reaches and the time at which this occurs?



$x = 20t - 5t^2$

$= 5t(4 - t)$

argument ✓

Max at $t = 2$

$20 \times 2 - 5 \times 2^2 = 20$

$\therefore$ Max is 20m ✓

* Should view on calculator!

(c) For how long is the stone more than 15 m above A?

$x = 15$

$15 = 20t - 5t^2$ ✓

* use 'solver'.

$5t^2 - 20t + 15 = 0$

$5(t^2 - 4t + 3) = 0$

$5(t - 3)(t - 1) = 0$

$t = 3$ or $t = 1$ ✓

$\therefore 3 - 1 = 2$ seconds ✓