PERTH MODERN SCHOOL
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Test Two ~~DRAFT~~

Semester One 2017
UNIT 1 METHODS

Calculator Free 35 minutes ***/30 marks***

Only Formula Sheet Permitted

Name: Solutions

Place a tick in the box next to your Mathematics teachers name:

Mr Strain	☐
Ms Sindel	☐
Ms Rimando	☐
Ms Reynolds	☐
Dr Pearce	☐
Mrs Flynn	☐
Ms Ensly	☐
Mrs Carter	☐

Question 1 **(3, 3 = 6 marks)**

Find the equation of each linear function

a) Passing through (2,-3) and (4,1)

$x_1\ y_1 \quad x_2\ y_2$

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{1-(-3)}{4-2}$

$= \frac{4}{2}$

$= 2$ ✓

At $(2,-3)$ $y = mx + c$

$-3 = 2(2) + c$ ✓

$-3 = 4 + c$

$c = -7$

$\therefore y = 2x - 7$ ✓

b) Perpendicular to the line $2x + y - 3 = 0$ and with x-intercept of -2.

$2x + y - 3 = 0$

$y = -2x + 3$

$m_1 = -2 \perp m_2 = \frac{1}{2}$ ✓

At $(-2,0)$ $y = mx + c$

$0 = \frac{1}{2}(-2) + c$ ✓

$0 = -1 + c$

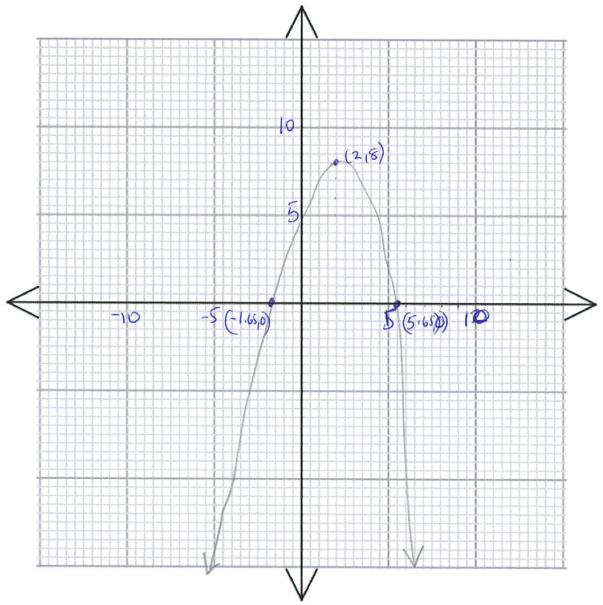
$c = 1$

$\therefore y = \frac{1}{2}x + 1$ ✓

6

Question 12 **(5 marks)**

Sketch the graph of $h = -0.6t^2 + 2.4t + 5.6$,indicate the major features.



Roots -1.65 ✓, 5.65 ✓

Max $(2,8)$ ✓

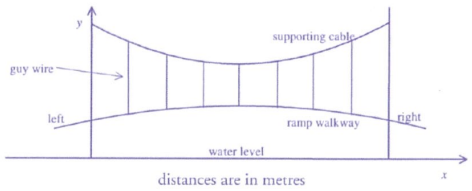
Shape ✓

Accuracy ✓

5

Question 11 **(1, 1, 2 = 4 marks)**

A ramp walkway is to be built over a ravine. It is to be attached to a supporting cable as shown in the diagram. Both the ramp walkway and supporting cable are in the shape of a quadratic function.



The equation of the ramp walkway is $y = -0.001x^2 + 0.062x + 18.04$

The equation of the supporting cable is $y = 0.003x^2 - 0.186x + 25.18$

a) Find the length of the shortest guy wire.

$22.297 - 19.001 = 3.296\text{m}$ ✓

b) What is the closest the ramp walkway is to the water surface?

18.04 ✓

c) How far from the left end is the supporting cable 24m above the water?

7.2m ✓, 54.8m ✓

4

Question 2 **(2 marks)**

Given the points (-3, 1) and (4, 2) find the **exact value** of the distance between them.

$d = \sqrt{(y_2-y_1)^2 + (x_2-x_1)^2}$

$= \sqrt{(2-1)^2 + (4-(-3))^2}$ ✓

$= \sqrt{1+49}$

$= \sqrt{50}$ ✓

$= 5\sqrt{2}$ units

Question 3 **(2 marks)**

The gradient of the straight line between (3, y) and (-2, 5) is $-\frac{3}{5}$. Find the value of y.

$m = \frac{y_2-y_1}{x_2-x_1}$

$\frac{3}{-5} = \frac{5-y}{-2-3}$ ✓

$\frac{3}{-5} = \frac{5-y}{-5}$

$\therefore y = 2$ ✓

Question 4 **(1, 1 = 2 marks)**

The quadratic equation $kx^2 + 5x - 3 = 0$ has exactly one real solution.

a) What is the value of the discriminant?

0 ✓

b) Hence, find the value of k.

$b^2 - 4ac = 0$

$5^2 - 4(k)(-3) = 0$ ✓

$25 + 12k = 0$

$k = -\frac{25}{12}$ ✓

6

Question 5 **(2, 2 = 4 marks)**

Solve the following quadratic equations giving exact answers

a) $x^2 + 2x - 15 = 0$

$(x+5)(x-3) = 0$

$\therefore x = -5$ or 3 ✓ ✓

b) $x^2 - 3x - 5 = 0$

$x = \dfrac{-b \pm \sqrt{b^2-4ac}}{2a}$

$= \dfrac{-(-3) \pm \sqrt{(-3)^2-4(1)(-5)}}{2(1)}$ ✓

$= \dfrac{3 \pm \sqrt{9+20}}{2}$

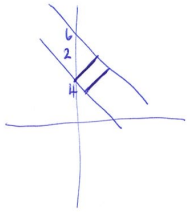
$= \dfrac{3+\sqrt{29}}{2}$ or $\dfrac{3-\sqrt{29}}{2}$ ✓

$1.5 \pm \sqrt{7.25}$

4

Question 10 **(4 marks)**

Calculate the shortest distance between the parallel lines $y + x = 4$ and $y + x = 6$. Leave your answer in exact form.



$y = -x + 4$

$y = -x + 6$

Line $\perp$ $y = -x + 4$ ✓

$m = 1$ At $(0,4)$

$y = mx + c$

$4 = 1(0) + c$

$c = 4$

$\therefore y = x + 4$ ✓

Intersection of $y = -x + 6$ and $y = x + 4$

$2y = 10$

$y = 5$

$\therefore y = x + 4$

$x = 1$ $(1,5)$ ✓

Distance $(0,4)$ and $(1,5)$

$d = \sqrt{(0-1)^2 + (4-5)^2}$

$= \sqrt{1+1}$

$= \sqrt{2}$ units ✓

4

Question 8 **(2, 2 = 4 marks)**

State the domain and range

a) (-3, 2), (2, 1), (0, 0), (1, 5), (4, -7), (2, 5)

Domain : $\{-3, 2, 0, 1, 4, 2\}$ ✓

Range : $\{2, 1, 0, 5, -7, 5\}$ ✓

b) $f(x) = \sqrt{3x - 6}$

Domain $\{x : x \in \mathbb{R}, x \geq 2\}$ ✓

Range $\{y : y \in \mathbb{R}, y \geq 0\}$ ✓

Question 9 **(3 marks)**

Demonstrate how to complete the square for $y = x^2 - 3x + 2$. Then state the turning point.

$y = \left(x - \frac{3}{2}\right)^2 + 2 - \frac{9}{4}$ ✓

$= \left(x - \frac{3}{2}\right)^2 + \frac{8}{4} - \frac{9}{4}$

$= \left(x - \frac{3}{2}\right)^2 - \frac{1}{4}$ ✓

$\therefore$ TP $= \left\{\frac{3}{2}, -\frac{1}{4}\right\}$ ✓

7

Question 6 **(2, 5 = 7 marks)**

Determine the rules for the following tables

a)

x	-7	-6	-5	-4	-3
y	11	10	9	8	7

-1 -1 -1 -1

$y = -1x + c$ ✓

At $(-4, 8)$ $8 = -1(-4) + c$

$8 = 4 + c$ ✓

$c = 4$

$\therefore y = -x + 4$

b)

x	1	2	3	4	5	6	7
y	2	2	4	8	14	22	32

-2 0 +2 +4 +6 +8

2 2 2 2

$\therefore c = 4$ ✓

$2a = 2$

$\therefore a = 1$ ✓

$-2 = a + b$

$-2 = 1 + b$ ✓

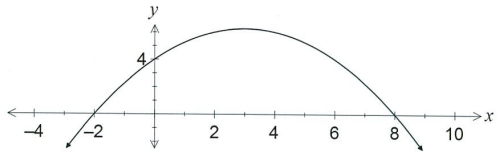
$b = -3$ ✓

$\therefore y = x^2 - 3x + 4$ ✓

7

Question 7 **(3, 2, 2 = 7 marks)**

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



Determine the values of the coefficients a and b.

$y = a(x+2)(x-8)$
$= a(x^2 - 6x - 16)$

At $(0,4)$ $\quad 4 = a(0 - 0 - 16)$
$4 = -16a$ ✓
$a = -\frac{1}{4}$ ✓

$y = -\frac{1}{4}(x^2 - 6x - 16)$
$= -\frac{1}{4}x^2 + \frac{6}{4}x + 4$ ✓

$\therefore \quad a = -\frac{1}{4}$
$b = \frac{3}{2}$ ✓

(b) A quadratic has equation $y = x^2 - 6x + 2$. Determine

(i) the coordinates of its turning point.

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

$\therefore$ TP $= (3, -7)$ ✓

(ii) the exact values of the zeros of the quadratic.

$(x-3)^2 - 7 = 0$ ✓
$(x-3)^2 = 7$
$x - 3 = \pm\sqrt{7}$
$x = 3 \pm \sqrt{7}$ ✓

7

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UNIT 1 METHODS

Calculator Assumed 15 minutes ***/20 marks***

Scientific Calculator, ClassPad, Formula Sheet and One page one side of A4 notes is permitted

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