Name: _____

MAT Methods: TOPIC TEST 2-Quadratic Functions, Powers Polynomial Functions and Inverse Functions

Course Weighting: 5% *Total Mark* */63 marks*

Section 1 : No Calculator allowed **Marks allocated: 20** **Time allowed 20 min**

Question 1 **[1, 2 = 3 Marks]**

(a) Given that, $f(x) = x^2 - 2x$ find:

(i) $f(-3)$ $f(-3) = (-3)^2 - 2(-3)$
$= 9 + 6 = 15$. ✓

(ii) a if $f(a) = 8$ $f(a) = 8$. $a^2 - 2a - 8 = 0$. ✓
$a^2 - 2a = 8$. $(a+2)(a-4)$ $a = -2$ or 4. ✓

Question 2 **[3, 2 = 5 Marks]**

Determine as simply as possible, if they intersect the x-axis and if they do, determine the specific location.

(a) $y = x^2 + 3x - 1$ $b^2 - 4ac = 9 - 4(1)(-1) =$ +ve ∴ yes. ✓

$\frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{-3 \pm \sqrt{13}}{2}$ ✓ or $\frac{-3-\sqrt{13}}{2}$ ✓

(b) $y = -2x^2 - x - 4$

$b^2 - 4ac = 1 - 4(-2)(-4) =$ -ve ∴ no solution ✓

Question 4 **[1, 2 = 3 Marks]** 1 2

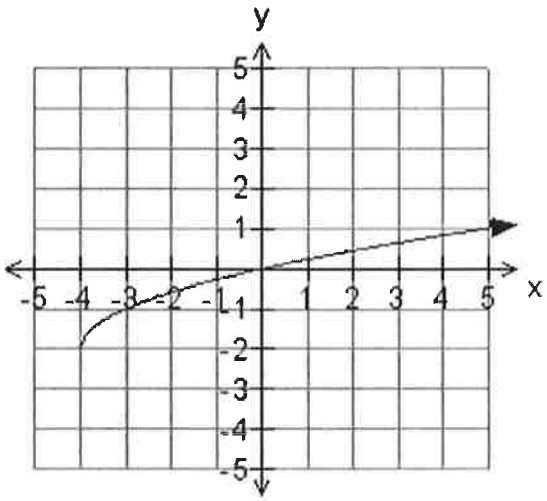
Write the vertical and horizontal asymptotes of the following equations.

a) $y = \frac{3}{x-6}$. vertical, $x = 6$
horizontal, $y = 0$ ✓

b) $y = \frac{1}{4x-3} + 2$ vertical $x = \frac{3}{4}$
horizontal $y = 2$. ✓

Question 5 [2, 2 = 4 Marks]

The function above has the equation $f(x) = \sqrt{x+p} + q$



(a) State the values of p and q.

$p = 4$ ✓

$q = -2$ ✓

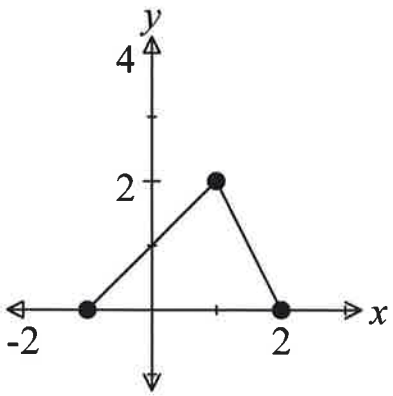
(b) State the domain and range of the function.

Domain $x: x \geq -4$. ✓

Range $y: y \geq -2$ ✓

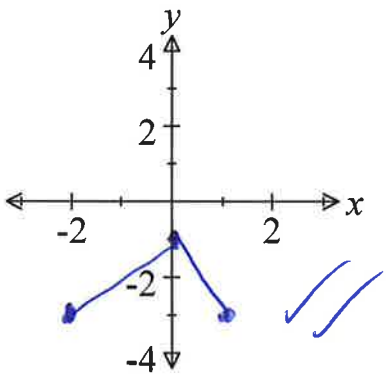
Question 7 [2, 2 & 2 = 6 Marks]

Consider the graph of y = f(x) below.



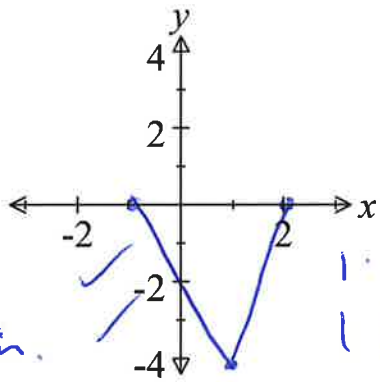
a) Sketch on the axes provided:

(i) y = f(x + 1) - 3



1 mark shape.
1 mark translation.

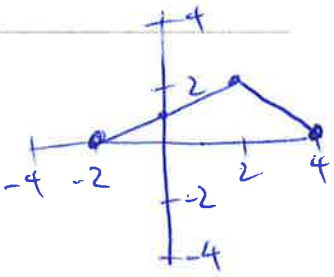
(ii) y = -2f(x)



1 · reflection
1 shape.

b) Find the x intercepts for $y = f(\frac{x}{2})$

(-2, 0) ✓ (4, 0) ✓



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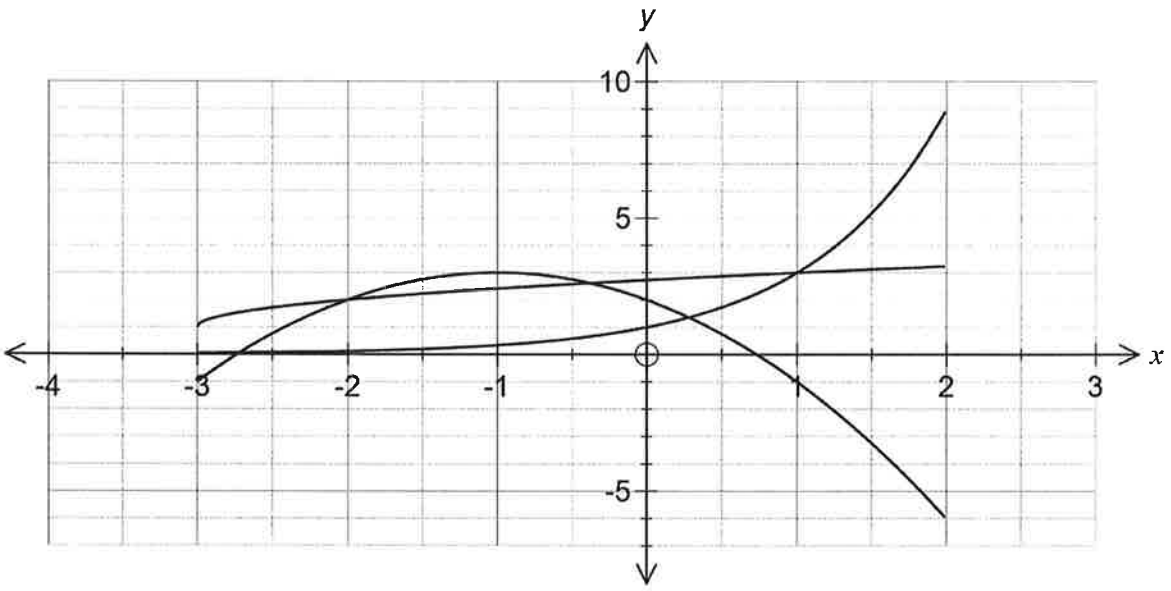
Section 2: Calculator allowed **Marks allocated: 43** **Time allowed 40 min**

2, 2, 1, 2 = (9 marks)

Question 8

The three functions below have been graphed over the domain $-3 \le x \le 2$.

$f(x) = 3^x$ $g(x) = 1 + \sqrt{x+3}$ $h(x) = 2 - 2x - x^2$



(a) Over the given domain, state the range of

(i) $f(x)$ $y: 0 \le y \le 9$ (2 marks)

(ii) $h(x)$ $y: -6 \le y \le 3$ (2 marks)

(b) Which function has symmetry when graphed over its natural domain? (1 mark)

$h(x)$

(c) State which function has an asymptote and write down it's equation. (2 marks)

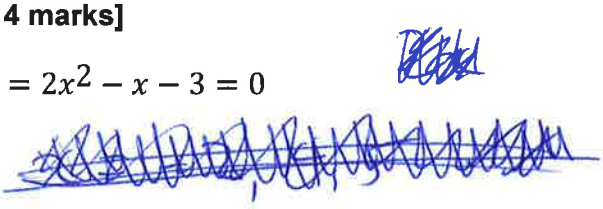
$f(x)$ $y = 0$

(d) Use the graph to estimate all solutions to $g(x) = h(x)$. (2 marks)

$(-2, -0.4)$

Question 9 [2,2 = 4 marks]

a) Solve $y = 2x^2 - x - 3 = 0$



$x = -1$ or $\frac{3}{2}$

b) Solve $y = (x-3)^2 = 4$

$x = 1$ or 5

Question 10. [2,2,1,2 = 7 marks]

A crane is used to lift and assemble the concrete panels used to construct an office building. On a six day of construction there are a total of 24 panels in place. Let P represent the number of panels and let d represent the number of days the building has been in construction.

(a) Explain why this is an example of direct rather than inverse, proportion.

As the numbe of days increase, the numb of panels constructed increases

(b) Determine k, the constant of proportionality.

$P = kd$

$24 = k \times 6$

$k = 4$

(c) Hence or otherwise establish a defining rule for this situation, using the variables P, for the number of panels, and, d for the number of days of construction.

$P = 4d$

(d) There are a total of 44 panels used to construct this building. How many days will it take to complete the assembly of the building?

$44 = 4d$

$d = 11$

Question 12 [1,5,1,1,1 2 = 11 Marks]

Joshua's Acme Bank shares were released on March 1, 1991. The value of v of a share in dollars was given by

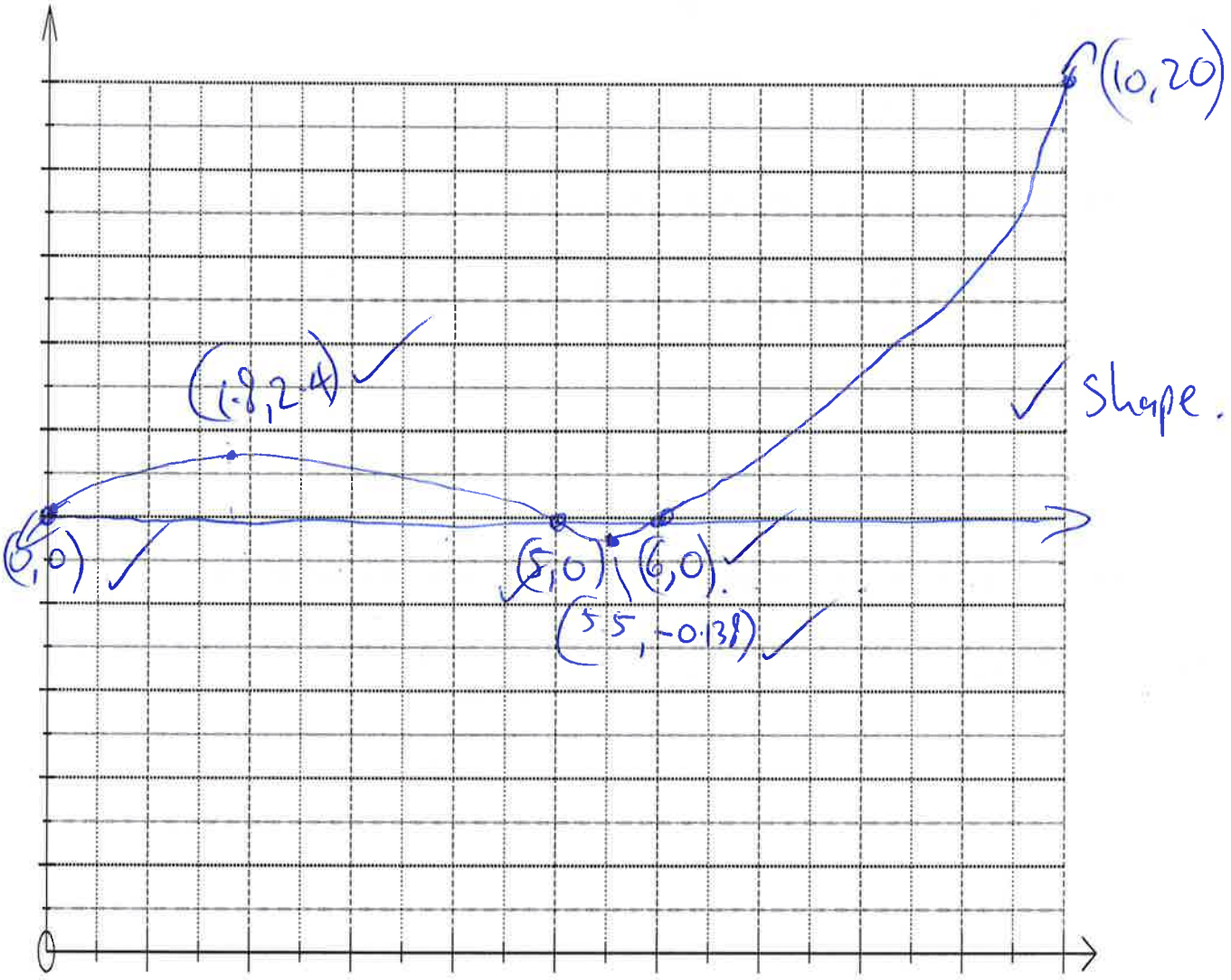
$$v(x) = 0.1x(x-5)(x-6) + 2.5, x \geq 0$$

Where x represents the number of months since March 1,1991

(a) What was the value of a share on March 1, 1991? On July 15, 1991?

$v(0) = 0.1(0)(0-5)(0-6) + 2.5 = \$2.5$ ✓

(b) Sketch the graph of the following cubic showing x and y intercepts and maximum and minimum points. $y = v(x) - 2.5$



~~2, 3 = 5 mrks.~~ [1, 2, 3 = 6 mrks.]

Question 13 ~~[3,3, = 6 Marks]~~

Determine the radius and the centre point of the following equations.

(a) $(x-2)^2+(y+5)^2=4$

radius = 2
centre point = (2, -5). ✓

(b) $x^2+8x-2y-8+y^2=0$

or $(x+4)^2+(y-1)^2=25$ ✓
radius = 5 centre point (-4, 1). ✓

(c) State the equation of the circle with a radius of 2 units and a center at the midpoint between the two centers of A and B

$\frac{(2+(-4))}{2}$; $\frac{(-5+1)}{2}$ ✓

mid point = (-1, -2). ✓

$(x+1)^2+(y+2)^2=4$ ✓

16.

Question 14 [2,1,2, 2 = 7 Marks]

Nick's toy rocket is fired into the air from ground level. The equation of the flight path was $h = -2t^2 + 20t$ where h is the vertical height is metres and t is the time since launch in seconds. Unfortunately the toy rocket crashed into the top of a streetlight, on the way down and was smashed into pieces.

a) At what time does the rocket reach its maximum height?

$h = -2t^2 + 20t$. ✓

$h = -2t(t - 10)$

$h = 0$ when $t = 0$ or 10 ∴ max at $t = 5$. ✓

b) What is the maximum height?

$h(5) = -2(5)^2 + 20(5)$.

$= \underline{50m}$. ✓

c) When was the rocket 25 metres in the air?

$-2t^2 + 20t = 25$

$-2t^2 + 20t - 25 = 0$

$t = \underline{1.46}$ ✓ or $\underline{8.54}$ ✓ sec.

d) The rocket crashed into the goal post after 9.5 seconds of flight. How tall is the streetlight?

$h(9.5) = -2(9.5)^2 + 20(9.5)$

$= \underline{9.5m}$. ✓