Question 7 **(7 marks)**

(a) Express $f(x) = \frac{6x-15}{x-3}$ into the form $f(x) = \frac{a}{x-h} + k$. (2 marks)

Without classpad

$\frac{6(x-3)+3}{x-3}$

$f(x) = 6 + \frac{3}{x-3}$ ✓ ✓

OR

$x-3 \overline{)6x-15}$ quotient 6

$6x-18$

$0 \quad +3$

With a classpad

$f(x) = \frac{a}{x-3} + 6$ ✓

sub $(0,5)$

$5 = \frac{a}{-3} + 6$

$-6 \qquad -6$

$-1 = \frac{a}{-3}$

$3 = a$

$f(x) = \frac{3}{x-3} + 6$ ✓

(b) Determine the coordinate of the x-intercept. (1 mark)

$(2.5, 0)$ ✓

(c) State the asymptotes of $f(x)$. (2 marks)

vertical asymptote $x = 3$ ✓

horizontal asymptote $y = 6$ ✓

(d) Hence, determine the range of $f(x)$. (2 marks)

$y \in \mathbb{R},\ y \neq 6$ ✓✓

OR

$(-\infty, 6) \cup (6, +\infty)$ ✓✓

END OF TEST

Test 2

Proportion, Functions, Relations & Transformations

Semester One 2019

Year 11 Mathematics Methods

Calculator Assumed

PERTH MODERN SCHOOL

Exceptional schooling. Exceptional students.

Name:	Sol
Teacher:	

Date: Friday 12th April 7.45am

You may have a formula sheet and 1 page (1 side) of notes for this test.

Total___________/ 41 **Total Marks:41** **Time: 45 Minutes**

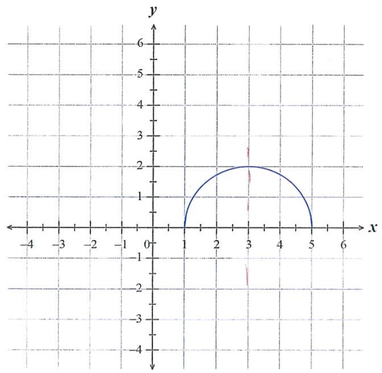
Question 1 **(3 marks)**

State whether the following relations are functions.

a) **{**(0, 0), (1, 1), (1, -1), (4, 2), (9, 3)**}**

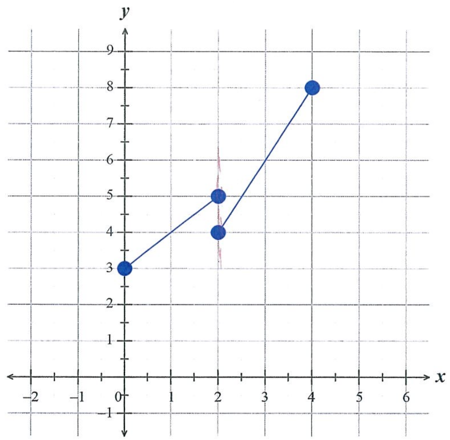
No / Relation ✓

b)



Yes / Function ✓

c)



No / Relation ✓

Question 6 **(4 marks)**

The time (t) in hours required to construct a retaining wall varies inversely to the number of workers (w) being employed. An engineer estimates that it will take 8 workers 180 hours to construct a retaining wall. [Assume that all workers work at the same rate.]

a) If the retaining wall must be constructed in 150 hours, how many extra workers will need to be employed? (3 marks)

$t \propto \frac{1}{w}$

$t = \frac{k}{w}$

$k = 8 \times 180$

$= 1440$ ✓

$150 = \frac{1440}{w}$

$w = 9,6$

$w \approx 10$ ✓

∴ He will need to hire 2 more workers. ✓

b) If only 6 workers are available, how long will they take to construct this wall? (1 mark)

$t = \frac{1440}{6}$

$= 240$ hours ✓

Question 5 **(9 marks)**

Consider the functions f and g where $f(x) = ax^2 + bx + c$ and $g(x) = f(2x + 3)$.

a) Given $f(-2) = 0, f(5) = 0$ and $f(2) = 3$, determine the rule for $f(x)$. (3 marks)

$f(x) = a(x+2)(x-5)$ ✓

sub $(2,3)$

$3 = a(4)(-3)$

$3 = -12a$

$-\frac{1}{4} = a$ ✓

$f(x) = -\frac{1}{4}(x+2)(x-5)$ ✓

OR

$-0.25x^2 + \frac{3}{4}x + \frac{5}{2}$

$-\frac{1}{4}x^2 + \frac{3}{4}x + \frac{5}{2}$

b) Express the rule for $g(x)$ as a polynomial. (3 marks)

$f(2x+3) = -\frac{1}{4}((2x+3)+2)((2x+3)-5)$ ✓

$= -\frac{1}{4}(2x+5)(2x-2)$ ✓

$= -\frac{1}{4}(4x^2 + 6x - 10)$

$= -x^2 - \frac{3}{2}x + \frac{5}{2}$ ✓

c) The coordinate $(1, 3)$ lies on $f(x)$. Determine the coordinate for $f(x) - 4$. (1 mark)

$(1, -1)$ ✓

d) Describe the sequence of transformations that would transform $f(x)$ to $g(x)$. (2 marks)

→ translate 3 units left ✓

→ dilate horizontally by s.f $\frac{1}{2}$ ✓ (-1 mark for incorrect order)

OR

$f(2(x+\frac{3}{2}))$

→ dilate horizontally by s.f $\frac{1}{2}$ ✓

→ translate $\frac{3}{2}$ units left ✓

YEAR 11 MATHEMATICS METHODS TEST 2 2019

Question 2 **(4 marks)**

Given that y is directly proportional to the square of x. When $y = 12$, $x = 4$, find

a) the constant of variation (2 marks)

$y \propto x^2$

$y = kx^2$

$12 = k(4^2)$

$12 = 16k$ ✓

$\frac{12}{16} = k$ ✓

$\frac{3}{4} = k$

b) the value(s) of x when y = 27 (2 marks)

$27 = \frac{3}{4}x^2$

$\frac{27 \times 4}{3} = x^2$

$36 = x^2$ ✓

$\pm 6 = x$ ✓ (for both solutions)

Question 3 **(8 marks)**

(a) Find the radius and the coordinate of the centre of the circle with equation $x^2 + y^2 - 4x - 6y - 3 = 0$. Show your working. (3 marks)

$x^2 - 4x + 4 - 4 + y^2 - 6y + 9 - 9 - 3 = 0$

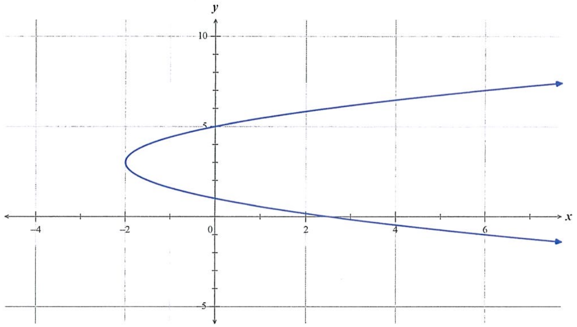
$x^2 - 4x + 4 + y^2 - 6y + 9 = 3 + 9 + 4$

$(x-2)^2 + (y-3)^2 = 16$ ✓

center $(2, 3)$ ✓

radius 4 ✓

(b) The variables x and y are related as demonstrated by this graph.



i) Determine the equation of the graph above. (3 marks)

$y^2 = x$

$(y-3)^2 = a^2(x+2)$ ✓

sub $(0,1)$ ✓

$(1-3)^2 = a^2(2)$

$4 = 2a^2$

$2 = a^2$ ✓ $\quad (y-3)^2 = 2(x+2)$

ii) State the domain. (1 mark)

$x \geq -2$ ✓

OR $[-2, \infty)$

c) From **(a)** and **(b)**, what features of their graphs clearly indicate that x is not a function of y? (1 mark)

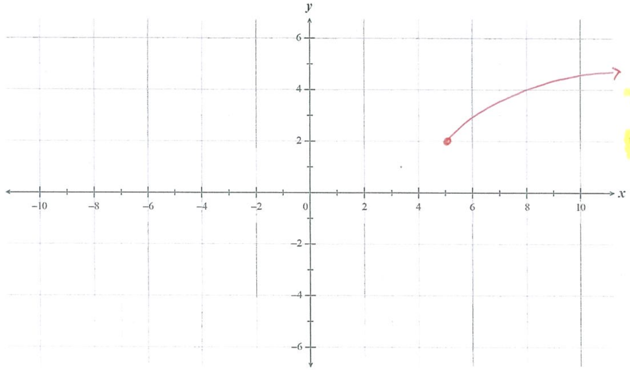
There are two y-values for the same x-value. ✓

Question 4 **(6 marks)**

The function $f(x) = \sqrt{x}$ is transformed into $g(x) = k\sqrt{(ax+b)} + c$ by the following sequence of transformations.

(a) Sketch the following transformation of $f(x)$.

'A translation 5 units in the positive x-axis followed by a translation of 2 units in the positive y-axis.' (2 marks)



✓ vertex

✓ shape

(b) Determine the equations of the resulting function $g(x)$.

i) A translation 3 units in the direction of the negative y-axis followed by a reflection about the x-axis. (2 marks)

$g(x) = -\sqrt{x} + 3$ ✓ ✓

ii) A dilation parallel to the positive x-axis of factor 2 followed by a translation 4 units in the direction of the positive x-axis (2 marks)

$g(x) = \sqrt{\frac{1}{2}(x-4)}$ ✓ ✓

OR

$g(x) = \sqrt{\frac{1}{2}x - 2}$ ✓ ✓