TOTAL = /40

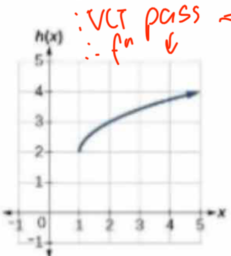
MCR 3U – Chapter 1 mid chapter test

Form is marked on each question

1. Fill in the blank (8 K marks)
   a. State an equation of parent function who has a D $\{x \in \mathbb{R} \mid x \geq 0\}$ $y = \sqrt{x}$
   b. State an equation of a parent function who has a range of all real numbers except zero $y = \frac{1}{x}$
   c. What is the name of the parent function $y = |x|$ Absolute Value
   d. What are the key points of the graph of $y = x^3$ $\{(-2,-8),(-1,-1),(0,0),(1,1),(2,8)\}$
   e. Draw a rough sketch of the parent function $y = \frac{1}{x}$ 
   f. State the name of the notation in the form: $f^{-1}(x)$ Inverse function
   g. If f(2)=1 then $f^{-1}(f(2))$ = 2
   h. If $g^{-1}(1)=0$ then 2g(0) = 2

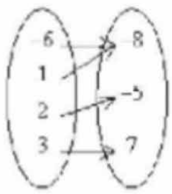
2. a) State the domain and range for each relation shown in the graphs and equations below.(6 K marks)
   b) State whether or not it is a function. State reasoning for all questions. (3 C marks)

∴ VLT pass ∴ fn ✓



i)

$D = \{x \in \mathbb{R} \mid x \geq 1\}$
$R = \{y \in \mathbb{R} \mid y \geq 2\}$



ii)

$D = \{-6, 1, 2, 3\}$
$R = \{-8, -5, 7\}$

iii) $y = |x+3| - 2$

$D = \mathbb{R}$
$R = \{y \in \mathbb{R} \mid y \geq -2\}$

3. Given the functions $f(x) = 2x - 1$ and $g(x) = x^2 - 2x$, determine the following(fully simplify):(6A marks)

a) g(f(2))
$= g(3)$
$= 3$

b) g(y-1)
$= y^2 - 2y + 1 - 2y + 2$
$= y^2 - 4y + 3$

c) f(f(1))
$= f(1)$
$= 1$

4. Given the function f = {(1,0),(3,-2),(2,0),(3,4),(0,-1),(-1,4)} determine the following(3 T marks)

a) f(3)
$= -2, 4$

b) f(f(f(1)))
$= f(f(0)) = f(-1) = 4$

c) if f(k) = 0 what is the value of k?
$k = 2, 1$

5. Determine the equation of the inverse for each of the following functions.

a) $y = \frac{2}{x+3} + 1$ (3 K marks)

$x = \frac{2}{y+3} + 1$; $(x-1)(y+3) = 2$; $y + 3 = \frac{2}{x-1}$; $\boxed{y = \frac{2}{x-1} - 3}$

b) $f(x) = 3x - 2$ (4 K marks)

let $y = 3x - 2$
$x = 3y - 2$
$x + 2 = 3y$
$y = \frac{x+2}{3}$
$f^{-1}(x) = \frac{x+2}{3}$

6. A function f(x) has the following properties (2 T marks)
   - the domain of f is the set of natural numbers
   - f(1)=1
   - f(x)=f(x-1)+3x(x+1)+1

Determine f(2), f(3)

$f(1) = 1$
$f(2) = f(1) + 3(2)(3) + 1$
$= 1 + 19$
$= 20$

$f(3) = f(2) + 3(3)(4) + 1$
$= 20 + 37$
$= 57$

Communication (5 C marks) – marks are awarded for proper communication from throughout the test.

TOTAL = /45

$y = af(k(x-d))+c$

Chapter 1 - Functions Test

1. Fill in the blank (11 C marks)

a. If |k|>1 the function is horizontally compressed

b. State the equation of a transformed parent function: domain all real numbers less than or equal to 3
$y = \sqrt{-(x-3)}$

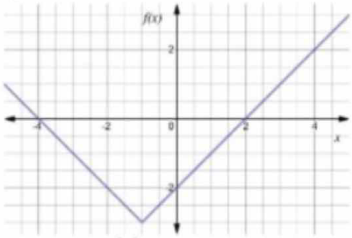
c. State the equation of a transformed parent function with range greater than -4 $y = 2^{x}-4$

d. In the function $y = 5\sqrt{-x}+1$ the values of a= 5 k = -1 d = 0 and c = 1

e. In the function $g(x) = -[2x-4]^3 - 5$. the values of a= -1 k = 2 d = 2 and c = -5

2. State the domain and range of each of the following transformed parent functions. (2 A marks

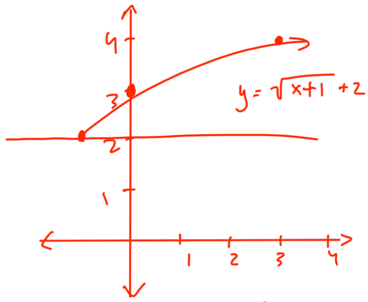
a)



$D = \mathbb{R}$
$R = \{y \in \mathbb{R} \mid y \geq -3\}$

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

$D = \{x \in \mathbb{R} \mid x \neq 2\}$
$R = \{y \in \mathbb{R} \mid y \neq 3\}$



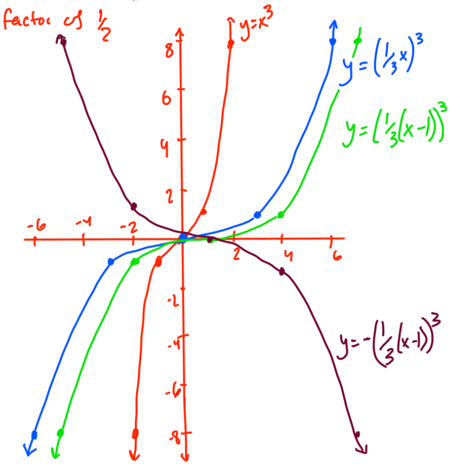
3. Draw a graph of $f(x)$ that satisfies the following. (3 T marks)
   1) Transformation of a parent function 2) Range all real numbers greater or equal to 2
   3) f(3)=4

4. State the name of the parent function and the transformations that have been applied to the function:
$y = -\frac{1}{3}|2(x-1)|$ Absolute value
Use correct terminology as discussed in class. (5 C marks)

- reflection over x-axis
- vertical compression by a factor of 1/3
- horizontal compression by a factor of 1/2
- shift 1 right

5. Graph the following functions. Show each step in the graphing process for full marks. Marks are given for properly labeling your graph. (4 A marks)

$$y = -\left(\tfrac{1}{3}(x-1)\right)^3$$

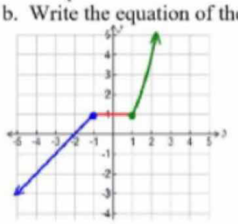


6. Given the piecewise function below.

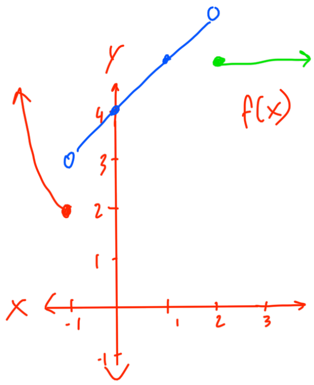
a. Graph the following function (4 A marks)

$$f(x) = \begin{cases} x^2+1, & x \leq -1 \\ x+4, & -1 < x < 2 \\ 5, & x \geq 2 \end{cases}$$

b. Write the equation of the piecewise function shown in the graph below (4 A marks)



$$f(x) = \begin{cases} x+2 & x \leq -1 \\ 1 & -1 < x < 1 \\ x^2 & x \leq 1 \end{cases}$$



7. a. Show how $y = -2g\left(\frac{1}{2}x-1\right)+1$ substitutes into the parent $g(x) = \frac{1}{x}$ (2 K marks)
b. Fully simplify the equation from a. (2 K marks)
c. Show how y = 3h(2x) + 3 substitutes into the parent function h(x) = |x| (2 K marks)

7 (a) $y = -\frac{2}{\frac{1}{2}x-1}+1$

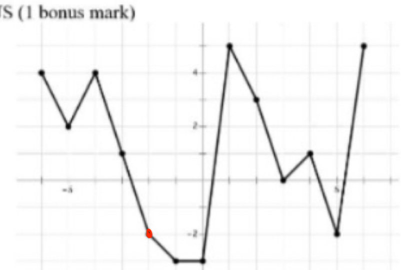
(b) $y = -\frac{2}{\frac{1}{2}(x-2)}+1$

$= -\frac{4}{x-2}+1$

(c) $y = 3|2x|+3$

(C 5) – Communication – marks will be awarded for proper form, units, etc from throughout the test

BONUS (1 bonus mark)



The figure above shows the graph of $f(x)$. If a is an integer such that $-6 < a < 6$ and $f(a) = a$, what is $f(f(f(a-3)) + f(f(f(f(2)))))$?

a=-2

$= f(f(f(-5))) + f(f(f(3)))$
$= f(f(2)) + f(f(0))$
$= f(3) + f(-3)$
$= 0 + 1$
$= 1$

TOTAL = /45

MCR3U Chapter 2 Test

1. Expand and simplify the following: (3 K marks)

   $(2x-y-2)^2 = 4x^2+y^2+4-4xy+4y-8x$

2. Factor each of the following expressions ***completely***: (no expanding) (2 K marks each)

   a) $8x^4-50y^6 = 2(4x^4-25y^6) = 2(2x^2+5y^3)(2x^2-5y^3)$ b) $12x^2-10x-8 = 2(6x^2-5x-4) = 2(3x-4)(2x+1)$ c) $8(2c-b)-c(b-2c) = (2c-b)(8+c)$

   d) $x^2-14xy+48y^2 = (x-8y)(x-6y)$ e) $(y-5)^2-(4-x)^2 = (y-5+4-x)(y-5-4+x) = (y-x-1)(y+x-9)$

3. Simplify each of the following. **State and classify** all restrictions. (3T marks)

   $$\frac{2m^2-mn-n^2}{4m^2-4mn-3n^2} = \frac{(2m+n)(m-n)}{(2m+n)(2m-3n)} = \frac{m-n}{2m-3n}$$

   $m \neq -n/2$ (h)
   $m \neq 3n/2$ (a)

4. Simplify the following. (**state and classify** restrictions) (a/b: 4 K marks each)(c : 6 A marks)

a) $\frac{x^4-1}{x^2-2x+1} \times \frac{x-1}{x^2+2x+1}$ b) $\frac{ab^2+2}{2ab^2} - \frac{b+2}{2b}$ c) $\left[\frac{x^2+5x+6}{x^2-3x+2} \div \frac{x+3}{x-1} - \frac{6}{x+3}\right]$

ⓐ $\frac{x^4-1}{x^2-2x+1} \times \frac{x-1}{x^2+2x+1} = \frac{(x^2+1)(x+1)(x-1)(x-1)}{(x-1)(x-1)(x+1)(x+1)} = \frac{x^2+1}{x+1}$

$x \neq -1$ (as.)
$x \neq 1$ (h)

ⓑ $\frac{ab^2+2}{2ab^2} - \frac{b+2}{2b} = \frac{ab^2+2-ab^2+2ab}{2ab^2} = \frac{1-ab}{ab^2}$

$a \neq 0$ (as.)
$b \neq 0$ (as.)

ⓒ $\frac{x^2+5x+6}{x^2-3x+2} \div \frac{x+3}{x-1} - \frac{6}{x+3} = \frac{\cancel{(x+3)}(x+2)\cancel{(x-1)}}{\cancel{(x-1)}(x-2)\cancel{(x+3)}} - \frac{6}{x+3}$

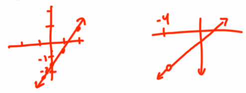
$= \frac{(x+2)(x+3)-6(x-2)}{(x-2)(x+3)}$

$= \frac{x^2-x+18}{(x-2)(x+3)}$

$x \neq 1$ (h)
$x \neq -3$ (as.)
$x \neq 2$ (as.)

5. $y = \frac{2x^2+5x-12}{2x+8} = \frac{(2x-3)(x+4)}{2(x+4)} = \frac{2x-3}{2} = x - 3/2$

   a) Simplify the expression, state and classify restrictions. (3 K marks) $x \neq -4$ (h)
   b) Draw the graph of the function (2 A marks)
   c) Clearly label asymptote(s) and/or hole(s). (1 C marks)



6. Determine the area of a triangle with base: $\frac{9y^2-4}{4y-12}$ and height: $\frac{18-6y}{9y^2+12y+4}$. State and classify any restrict

   marks)

$A = \frac{1}{2}bh = \frac{1}{2}\left(\frac{9y^2-4}{4y-12}\right)\left(\frac{18-6y}{9y^2+12y+4}\right)$

$= \frac{6\cancel{(3y+2)}(3y-2)\cancel{(3-y)}}{-12\cancel{(y-3)}\cancel{(3y+2)}(3y+2)}$

$= \frac{3y-2}{-2(3y+2)}$

$y \neq 3$ (h)
$y \neq -2/3$ (as.)

7. Rewrite $\frac{3}{x^2-x-2}$ as a sum or difference of two rational expressions with DIFFERENT bases and solve it to s

   equals the expression given. (2 T marks)

Communication (4 C marks) – marks awarded for proper units and form from throughout the test.

$\frac{3}{x^2-x-2} = \frac{3}{(x-2)(x+1)}$

$= \frac{A}{(x-2)} + \frac{B}{(x+1)}$

$= \frac{A(x+1)+B(x-2)}{(x+1)(x-2)}$

$\therefore A(x+1)+B(x-2) = 3$

let $x=-1$
$B(-3)=3$
$B=-1$

let $x=2$
$A(3)=3$
$A=1$

$$\boxed{\frac{1}{(x-2)} - \frac{1}{(x+1)}}$$

Proof

$LS = \frac{3}{x^2-x-2}$

$RS = \frac{1}{x-2} - \frac{1}{x+1}$

$= \frac{x+1-x+2}{(x-2)(x+1)}$

$= \frac{3}{x^2-x-2}$

TOTAL = /42

MCR3U Chapter 3 Test

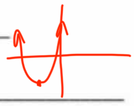
$y = x^2 + 6x - 2$

$y = (x+3)^2 - 11$

1. Fill in the blank (12 C marks)

a. Given the following quadratic $y = x^2 + 6x - 2$

   a. Domain: $\mathbb{R}$
   b. Range: $\{y \in \mathbb{R} \mid y \geq -11\}$
   c. Vertex: $(-3, -11)$
   d. Direction of opening: up
   e. Axis of symmetry: $x = -3$
   f. Current form the quadratic is given in is called: standard
   g. Number of zeros: two
   h. Sketch the graph (rough sketch-include: opening, approx. vertex)



b. Given the following quadratic: $g(x) = (2x - 1)(x - 5)$

   a. X-intercepts: $(\frac{1}{2}, 0)$ & $(5, 0)$
   b. Axis of symmetry: $= (\frac{1}{2}+5)/2 = (\frac{11}{2})/2 = \frac{11}{4}$
   c. Number of zeros: two
   d. Current form the quadratic is given in is called: factored

2. Simplify the following (3 K marks)

$\sqrt{2}\left(2\sqrt{8} - 3\sqrt{32} + 4\sqrt{50}\right) = 8 - 24 + 40$

$= 24$

3. Solve by expanding and factoring $(x+3)(x-5) = 3(x+7)$ (4 K marks)

$x^2 - 5x - 36 = 0$

$(x-9)(x+4) = 0$

$x = 9, -4$

4. Find the x-intercepts using the quadratic formula. Answers should be fully simplified (reduced radical form if applicable $y = x^2 - 4x + 1$ (4 K marks)

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{4 \pm \sqrt{12}}{2} = 2 \pm \sqrt{3}$

$x_1 = 2 + \sqrt{3}$, $x_2 = 2 - \sqrt{3}$

5. Determine the point(s) of intersection of the parabola $y = 2x^2 + 12x + 10$ and the line $y = 4x + 2$ (5 T marks)

① ②

sub ① into ②

$2x^2 + 12x + 10 = 4x + 2$

$2x^2 + 8x + 8 = 0$

$(x+2)^2 = 0$

$x = -2$

sub x into ②

$y = 4(-2) + 2$

$y = -6$

$\therefore$ The PoI is $(-2, -6)$.

6. A rectangle has an area of 60m². One side is 7m longer than the other. What are the dimensions of the rectangle? You must set up and solve the equation for full marks. Be sure to include let statements. (5A marks)

let s represent a side.

① $60 = (s+7)(s)$

$0 = s^2 + 7s - 60$

$0 = (s+12)(s-5)$

$s = -12, 5$

$\because -12$ is invalid

$\therefore$ The dims are $5m \times 12m$

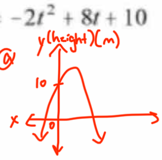
7. A ball is thrown off the roof of the school. It's path can be described by the equation $h(t) = -2t^2 + 8t + 10$ where h is the height in metres after t seconds.

a) Sketch (1 C mark)

b) What height was the ball thrown from? Show your work. (1 A marks)

c) What time did it take for the ball to reach max height? Show your work. (3 A marks)

ⓐ



ⓑ $(0, 10)$: y-int

$\therefore$ The ball was thrown from 10m

ⓒ $h(t) = -2t^2 + 8t + 10$

$= -2(t-2)^2 + 18$

$V(2, 18)$

$\therefore$ It took 2s to reach the max height.

Communication (4 C marks) – marks are awarded for proper form, units, etc from throughout the test

BONUS: (1 bonus mark) Determine the value(s) of k such that the following quadratic has one x-int

$$(x^2 - 1)k = (x - 1)^2$$

$k = 0$

$x^2 - 2x + 1 - kx^2 + k = 0$

$\underbrace{x^2(1-k)}_{a} \underbrace{-2x}_{b} + \underbrace{1+k}_{c} = 0$

$D = b^2 - 4ac$

$0 = b^2 - 4ac$

$0 = (-2)^2 - 4(1-k)(1+k)$

$0 = 4 - 4 + 4k^2$

$0 = 4k^2$

$0 = k^2$

$\boxed{k = 0}$