Question 1

A car travels at a constant speed of 110 Km/hour between Montreal and Toronto.

Determine the independent variable for this functional situation.

distance travelled

Time

Answer: Time

Question 2

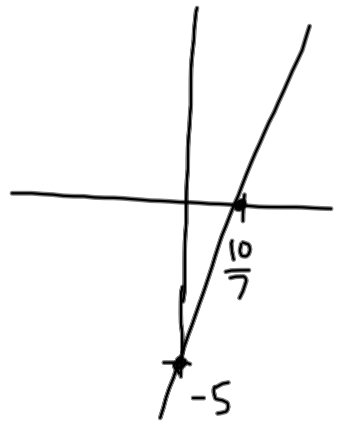
A function is described by the following rule:

$$f(x) = \frac{7x}{2} - 5$$

$f(x) = 0$

$0 = \frac{7}{2}x - 5$

$\frac{5}{\frac{7}{2}} = \frac{\cancel{\frac{7}{2}}x}{\cancel{\frac{7}{2}}} \rightarrow x = \frac{10}{7}$



a) Determine over which interval the function is negative.

Answer: $-\infty, \frac{10}{7}[$

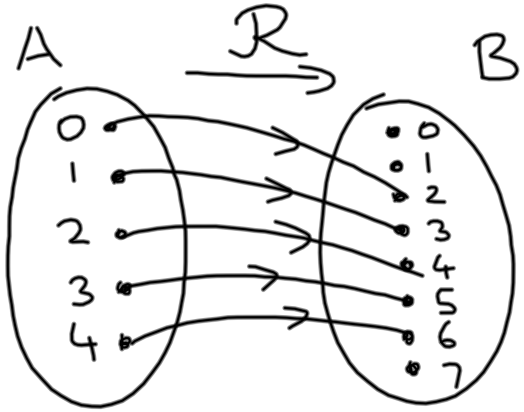
b) Determine the rate of change of this function.

slope

Answer: $m = \frac{7}{2}$

Question 3

Use set-builder notation to define the relation illustrated below.

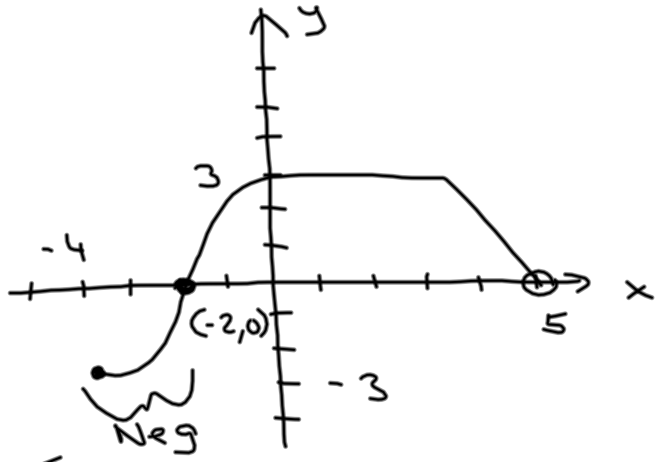


$y = x + 2$

Answer: $\mathcal{R} = \{(x, y) \in A \times B \mid y = x + 2\}$

Question 4

The graph below represents situation f(x). Determine the following characteristics of this function.



a) Domain: [-4, 5[

b) Range: [-3, 3]

c) An interval over which the function is both increasing and negative: [-4, -2[

d) f(-2) = 0

e) The maximum of f(x) : 3

Question 5

A function is described by the following rule:

$$f(x) = 2x^2 - 3$$

a) Determine the interval over which this function is positive.

x-intercept(s)

Answer: $-\infty, -1.22[\cup]1.22, +\infty$

b) Determine the interval over which this function is increasing.

Vertex

Answer: $]0, +\infty$

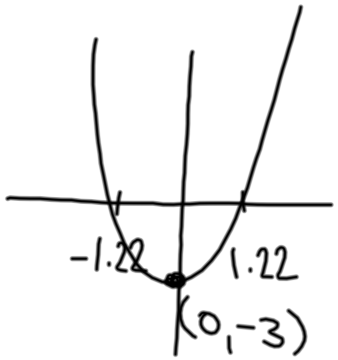
$f(x) = 0$

$0 = 2x^2 - 3$

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

$\sqrt{x^2} = \pm\sqrt{\frac{3}{2}} \rightarrow x = \pm\sqrt{\frac{3}{2}}$

$x = \pm 1.22$



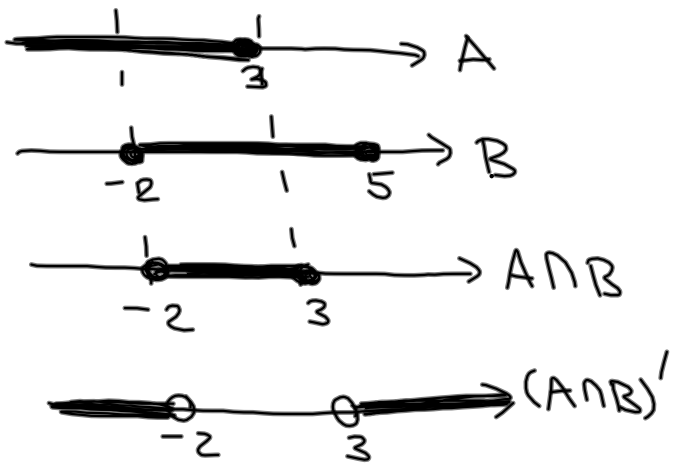
Question 6

Given the following sets:

$A = \{x \in R \mid x \le 3\}$ $B = \{x \in R \mid -2 \le x \le 5\}$

Perform the following set operations: $(A \cap B)'$

Graph the detailed solution below.



Give your answer in interval notation: $-\infty, -2[\cup]3, +\infty$

Question 7

Given the following intervals:

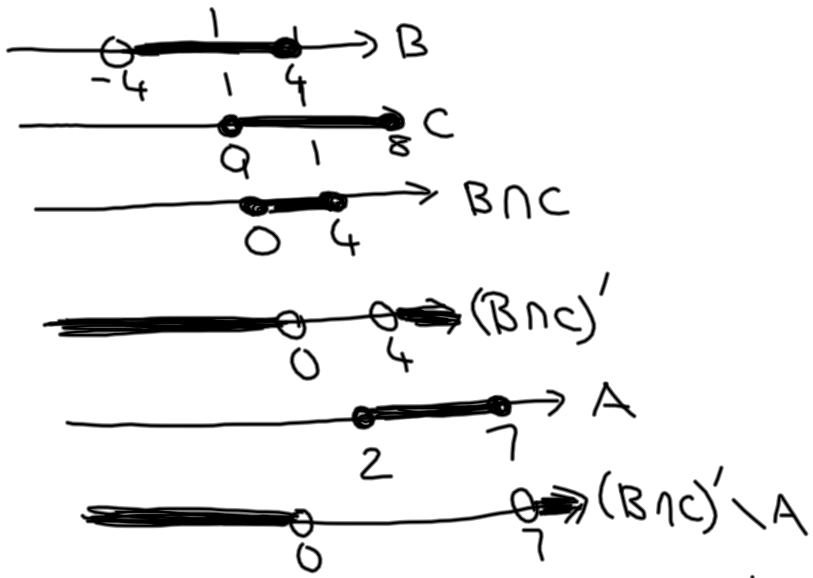
A = [2, 7]

B =] -4, 4]

C = [0, 8]

Perform the following set operations: $(B \cap C)' \backslash A$

Graph the detailed solution below:



Give your answer in set-builder notation: $\{x \in \mathbb{R} \mid x < 0 \cup x > 7\}$

Question 8

Graph the following relation in a Cartesian plane:

$$R = \{(x, y) \in R \times R \mid 3x - 2y + 5 > 0\}$$

$3x - 2y + 5 = 0$

$\frac{3x + 5}{2} = \frac{\cancel{2}y}{\cancel{2}}$

$y = \frac{3x+5}{2}$

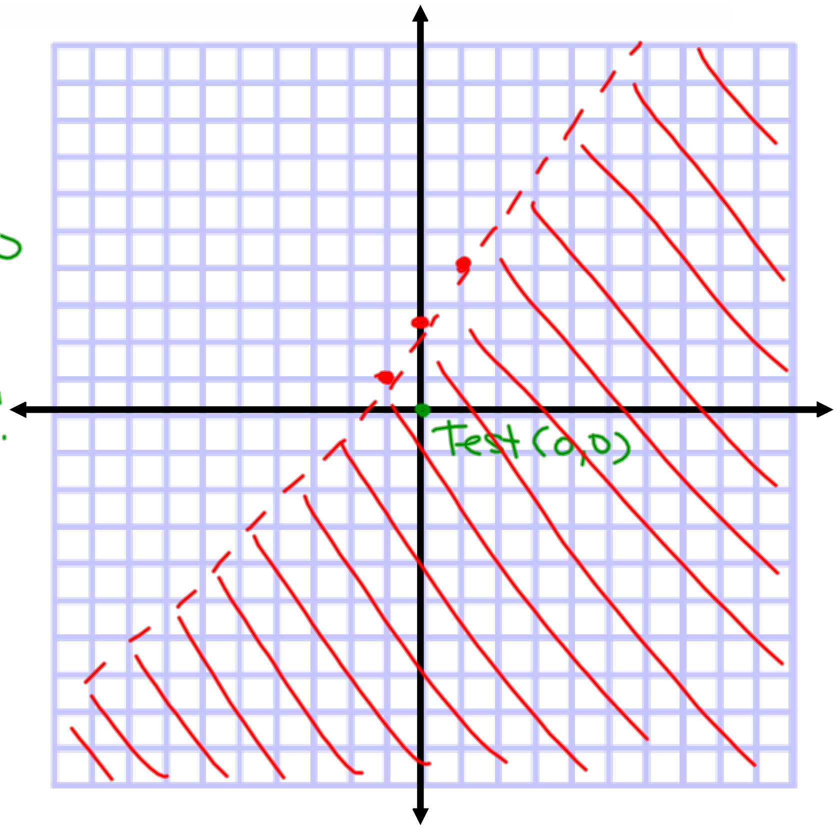
x	y
-1	1
0	2.5
1	4

test (0,0)

$3(0) - 2(0) + 5 > 0$

$5 > 0$

TRUE!



Determine the domain and range.

Domain = $-\infty, +\infty$ Range = $-\infty, +\infty$

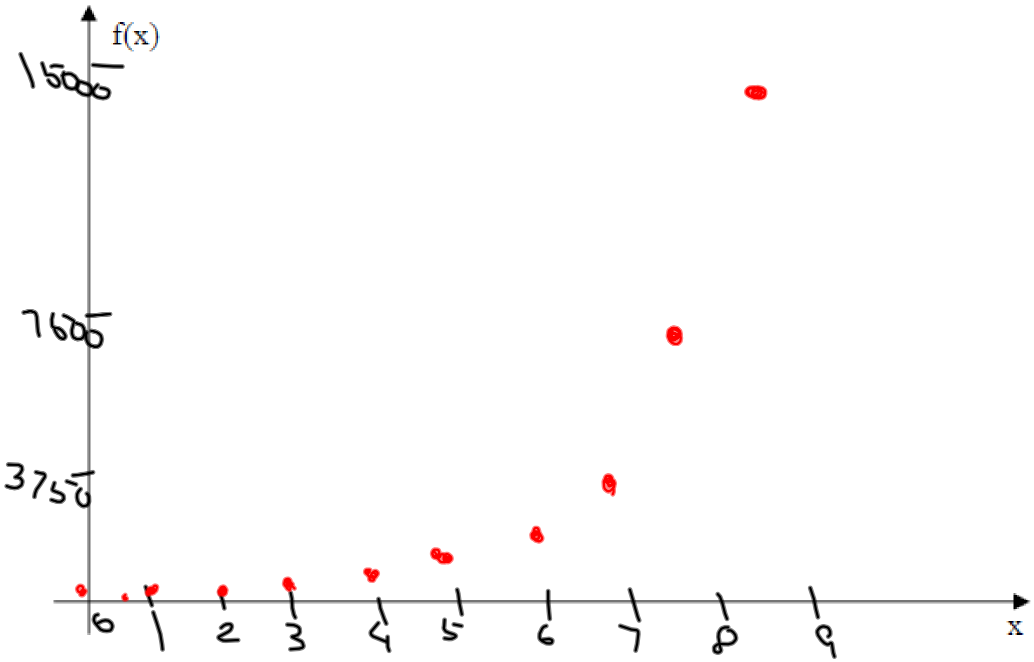
Question 9

While playing no-limit Texas Hold'em poker, you are down to 30$ in chips. There are 15 000$ of chips in play. In order to win, you will have to double your chips several times in a row.

a) Complete the following table of values:

x (Number of Double-ups)	0	1	2	3	4	5	6	7	8	9	10
f(x) (Chip total)	30$	60$	120	240	480	960	1920	3840	7680	~~15360~~ 15000	

b) Graph this functional situation.



c) Is the function increasing or decreasing? Answer: Increasing

Explain your answer: Doubling chips each time

d) What is the range of this function?

Answer: {30, 60, 120, 240, 480, 960, 1920, 3840, 7680, 15000}

Question 10

Six representations are given below.

A

$f(x) = 2x - 3$

B

g(x) = The image of an element obtained by subtracting 3 from twice this element.

C

x	h(x)
-5	22
-4	13
-3	6
-2	1
-1	-2
0	-3
1	-2
2	1
3	6
4	13
5	22

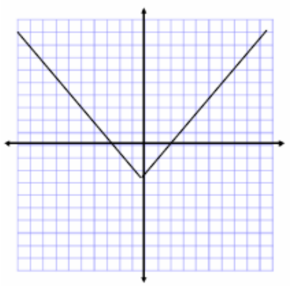
D

$i(x) = x^2 - 3$

E

x	j(x)
-5	-13
-4	-11
-3	-9
-2	-7
-1	-5
0	-3
1	-1
2	1
3	3
4	5
5	7

F



Three of these representations correspond to the same function f_1 and two of them correspond to another function f_2.

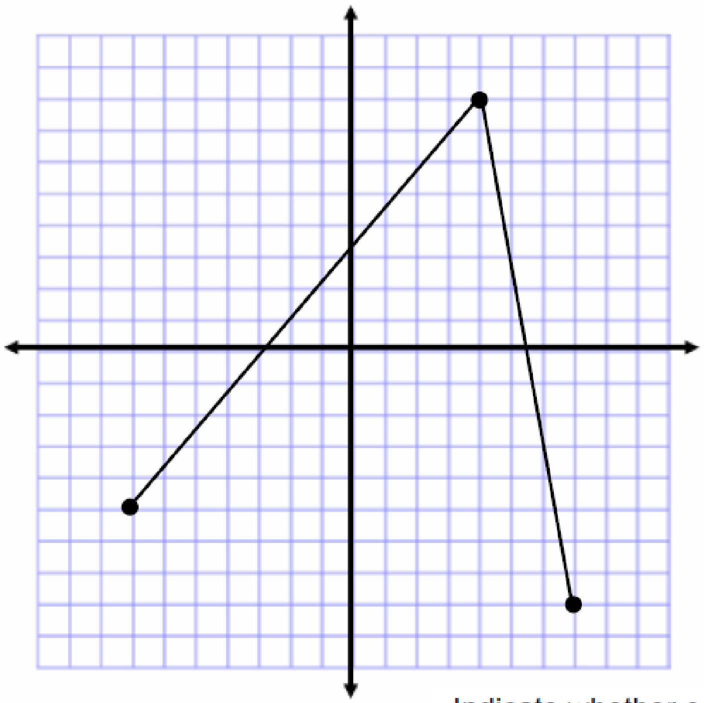
Indicate which representations correspond to each function,

f_1: A, B, E

f_2: C, D

Question 11

The following graph represents functional situation f.



Indicate whether each of the following statements is true or false.

a) The function has a minimum and two maximums. False

b) The domain is] -7, 7 [False

c) The function has no axis of symmetry. TRUE

d) The y-intercept is (0,4) False

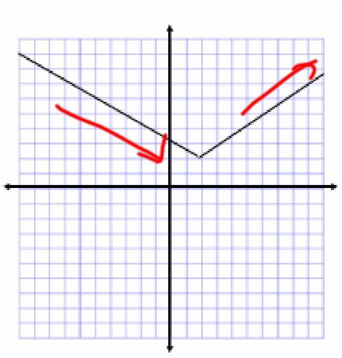
Question 12

Function *f* has all of the following characteristics:

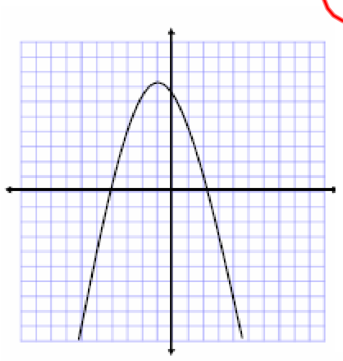
- It has a minimum.
- It has no zeroes.
- It is increasing over its entire domain.

Which of the following graphs could represent function *f* ?

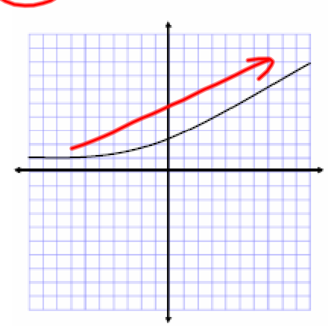
A.



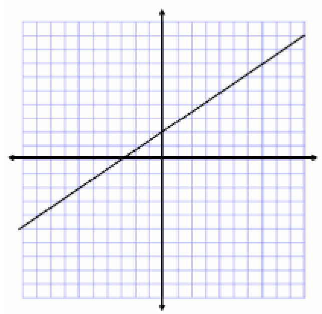
B.



C.

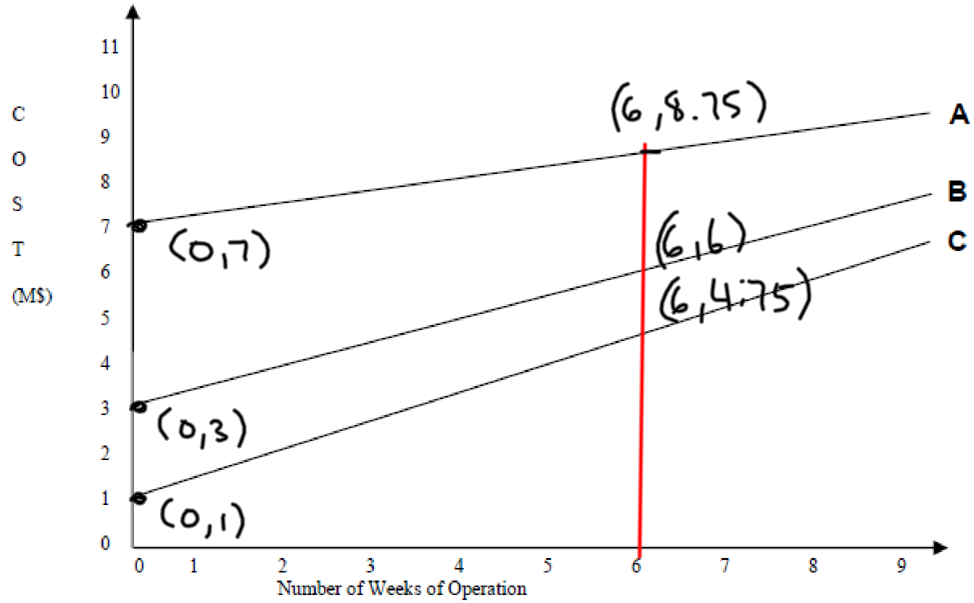


D.



Question 13

An accounting firm decides to compare the operating costs of three paper producing companies that are their clients. The graphs below represent each company's costs per week:



A: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8.75 - 7}{6 - 0} = \frac{1.75}{6} = 0.29$

y-int $(0,7)$

$A(x) = 0.29x + 7$

B: $m = \frac{6-3}{6-0} = \frac{3}{6} = 0.5$

y-int $(0,3)$

$B(x) = 0.5x + 3$

C: $m = \frac{4.75-1}{6-0} = \frac{3.75}{6} = 0.625$

y-int $(0,1)$

$C(x) = 0.625x + 1$

Which company will have the highest operating costs after 26 weeks?

Clearly show all your work.

$A(26) = 0.29(26) + 7 = 14.54$

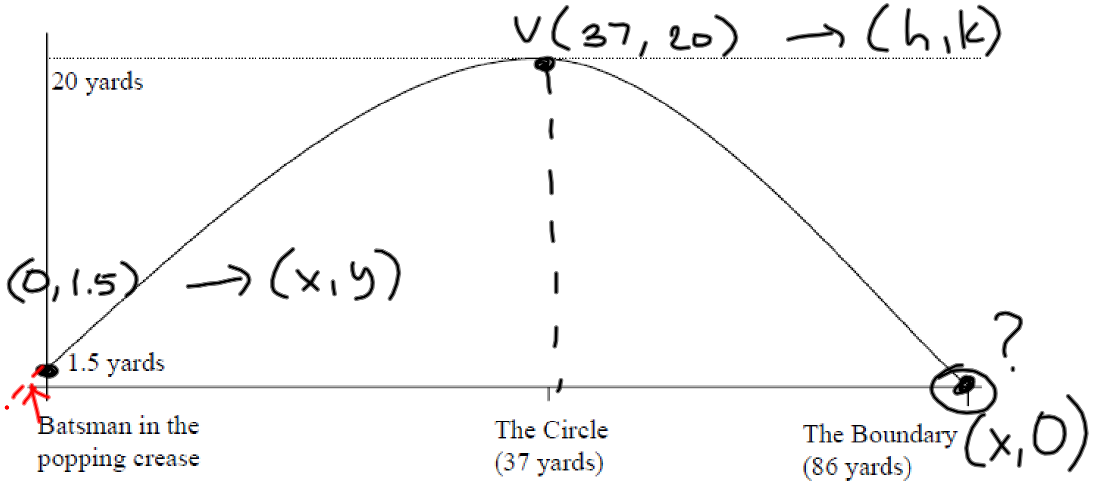
$B(26) = 0.5(26) + 3 = 16$

$C(26) = 0.625(26) + 1 = 17.25$

Company C

Question 14

During a cricket match, a batsman hits a ball that reaches a maximum height of 20 yards at the edge of the circle (37 yards away from him). If the ball was initially hit at a height of 1.5 yards, will it make the boundary (86 yards away from him) and score him 6 runs?



$$y = a(x-h)^2 + k$$

$$1.5 = a(0-37)^2 + 20$$

$$\frac{-18.5}{1369} = \frac{a(\cancel{1369})}{\cancel{1369}}$$

$$a = -0.0135$$

$$y = -0.0135(x-37)^2 + 20$$

$$0 = -0.0135(x-37)^2 + 20$$

$$\frac{-20}{-0.0135} = \frac{\cancel{-0.0135}(x-37)^2}{\cancel{-0.0135}}$$

$$\pm\sqrt{1481.48} = \sqrt{(x-37)^2}$$

$$\pm 38.48 = x - 37$$

$$x = 37 \pm 38.48$$

$$x' = 37 + 38.48 = 75.48$$

$$x'' = 37 - 38.48 = \cancel{-1.48}$$

Clearly show all your work.

the ball went 75.48 yards, so short of the boundary.

Question 15

Two model rocket enthusiasts, George and Henry, have figured out that the equations that will represent their rocket's altitude in meters are:

$$G(t) = -t^2 + 30t$$
$$H(t) = -t^2 + 36t - 100$$

where t represents the time in seconds after launch.

Which rocket reached the highest altitude? Clearly show all your work.

Maximum $\longrightarrow$ Vertex!!!

$G(t) = -t^2 + 30t$

$a = -1$
$b = 30$
$c = 0$

$\Delta = b^2 - 4ac$
$= (30)^2 - 4(-1)(0)$
$\Delta = 900$

$V\left(\frac{-b}{2a}, \frac{-\Delta}{4a}\right)$
$V\left(\frac{-30}{2(-1)}, \frac{-900}{4(-1)}\right)$
$V(15, 225)$

$H(t) = -t^2 + 36t - 100$

$a = -1$
$b = 36$
$c = -100$

$\Delta = 36^2 - 4(-1)(-100)$
$= 1296 - 400$
$\Delta = 896$

$V\left(\frac{-36}{2(-1)}, -\frac{896}{4(-1)}\right)$
$V(18, 224)$

George's rocket went higher by 1 m.