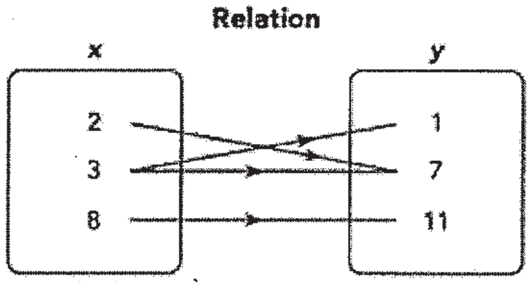
Review for Quest #8 – Linear and Nonlinear Functions

Name ______________________________ Class __________

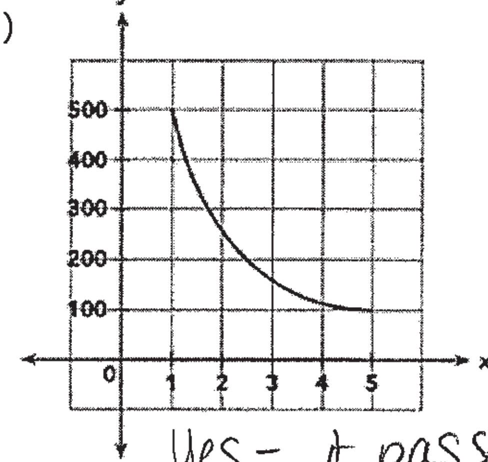
1.) Determine if the following relations are functions. Explain your reasoning.

a.)



No this is not a function because an input has more than 1 output.

b.)

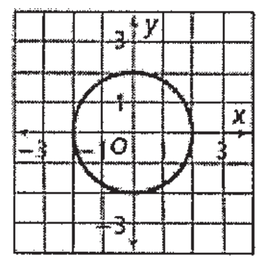


Yes – it passes the VLT

c.) $\{(1,1),(2,2),(3,5),(4,10),(5,15)\}$

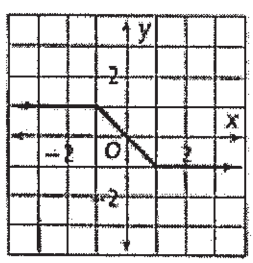
Yes – each input has only 1 output.

d.)



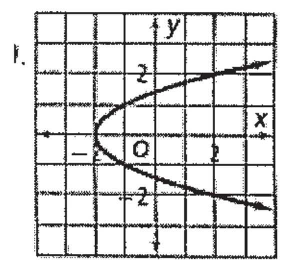
No – it doesn't pass the VLT.

e.)



Yes, it passes the VLT.

f.)



No – it doesn't pass the VLT.

2.) Determine whether the relations below are linear or nonlinear. Explain your reasoning.

a.) $y = 2x - 5$

Linear – Its in the format $y = mx + b$.

b.) $y = -3x^2 - 4$

Non-linear – there is a squared term.

c.) The equation $V = e^3$ gives the volume of a cube as a function of its edge length, e.

Nonlinear – there is a cubed term

d.)

+1 +1 +1

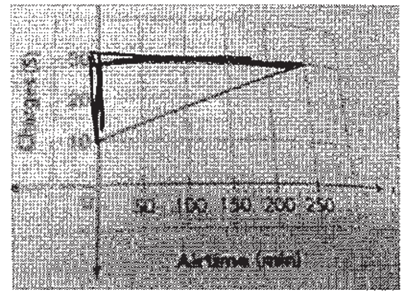
Input, Time (min)	1	2	3	4
Output, Temperature (°F)	−1	−2	−3	−4

−1 −1 −1

$m = \frac{\Delta y}{\Delta x} = \frac{-1}{1} = -1 \rightarrow$ Linear – constant rate of change.

3.) Joey and Peter each pay a fixed amount each month to use a cell phone. They each also pay for each minute that they make calls on the phone.

a.) The graph shows the amount, y dollars, Joey pays in a given month, based on the airtime, x minutes, he uses to make calls. Write an equation that represents how much Joey pays in y dollars each month based on x minutes of airtime.



$m = \frac{\Delta y}{\Delta x} = \frac{\$20}{250 \text{ min}} = \$0.08/\text{min}$

$b = \$10$ (starts @ $10)

$\boxed{y = 0.08x + 10}$

b.) Peter pays $20 each month and pays $0.05 per minute. Write an equation that represents how much Peter pays in y dollars each month based on x minutes of airtime.

$m = \$0.05/\text{min}$
$b = \$20$

$\boxed{y = 0.05x + 20}$

c.) Who pays a greater initial fee? Explain.

Peter - he pays $20 - Joey only pays $10.

(A) d.) Who pays more per ~~[illegible]~~ minute? Explain.

Joey - he pays $0.08/min while Peter pays only $0.05/min.

4.) The table shown represents a linear function.

a.) Find the slope and the y-intercept of the function.

(-4, 2)
(0, 5)

① $m = \frac{5-2}{0+4}$

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

② $y = \frac{3}{4}x + b$

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

$2 = -3 + b$
$+3 \quad +3$
$b = 5$

$\boxed{y = \frac{3}{4}x + 5}$

x	y
-4	2
0	5
4	8
8	11

b! → 0

b.) Which equation has a greater slope and a greater y-intercept than the linear function shown in the table? **(4 points)**

~~(A)~~ $y = x + 4$

~~(C)~~ $y = \frac{3}{4}x + 5$

(B) $y = 2x + 6$

~~(D)~~ $y = \frac{1}{2}x + 8$

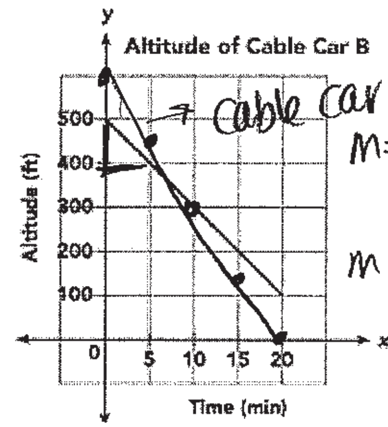
Explanation:
B has a slope of 2, which is greater than 3/4.
B has a y-int. of 6, which is greater than 5.

5.) Two cable cars are descending from two separate stations. The altitude, y feet, of Cable Car A after x minutes is given in the table shown below. The graph below shows the altitude, y feet, of Cable Car B after x minutes.

Cable Car A

Time (min)	Altitude (ft)
0	600
5	450
10	300
15	150
20	0

(0,600)
(5,450)



→ cable car A.

$m = \frac{\text{rise}}{\text{run}}$

$m = \frac{-100\text{ft}}{5\text{min}}$

$m = -20\text{ft/min}$

a.) Determine an equation to model the path of Cable Car A.

① $m = \frac{450-600}{5-0}$ ② $b = 600$ (starting amt)

$m = \frac{-150}{5} = -30\text{ft/min}$. $\boxed{y = -30x + 600}$

b.) Determine an equation to model the path of Cable Car B.

$m = -20\text{ft/min}$ (see work above)

$b = 500$ ft (starting amt)

$\boxed{y = -20x + 500}$

c.) Which cable car is descending from a higher altitude? Justify your answer.

Cable car A – starts at 600 ft while B starts at 500 ft

d.) Which cable car is descending at a faster rate? Justify your answer.

Cable car A – descending at a rate of 30 ft/min as opposed to 20 ft/min

e.) How long will it take for the two cable cars to have the same altitude? What will that altitude be?

1) solve graphically (see above)

$\boxed{10 \text{ min}}$

2) solve algebraically

$-30x + 600 = -20x + 500$
$+30x \qquad\qquad +30x$
$600 = 10x + 500$
$-500 \qquad\quad -500$
$100 = 10x$ → $\boxed{x = 10 \text{ min}}$

6.) Veronica created two functions.
For Function A, the value of y is seven less than three times the value of x. The table included represents Function B. In comparing the average rates of change, which statement about Function A and Function B is true?

Function B

x	y
-4	5
-1	11
2	17
5	23

(2,17)
(5,23)

~~(A) Function A and Function B have the same rate of change.~~
(B) Function A has a greater rate of change than Function B.
~~(C) Function B has a greater rate of change than Function A.~~
~~(D) Function A and Function B both have a negative rate of change.~~

Function A:
$y = 3x - 7$ $m = 3$ ← A

$m = \frac{23-17}{5-2} = \frac{6}{3} = 2$

B → $m = 2$