5) Linear Functions

34. Which relation is not a function?

(2) {(-1,6), (1,3), (2,5), (1,7)}

The input (1) has been assigned to two outputs (3 & 7)

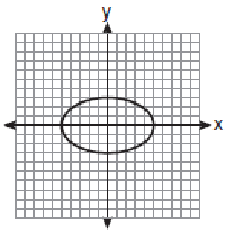
(1) $\{(1,5),(2,6),(3,6),(4,7)\}$

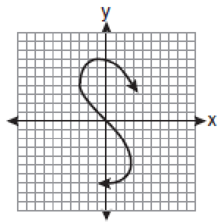
(2) $\{(-1,6),(1,3),(2,5),(1,7)\}$

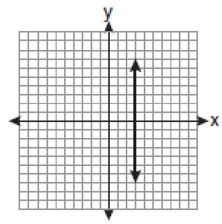
(3) $\{(4,7),(2,1),(-3,6),(3,4)\}$

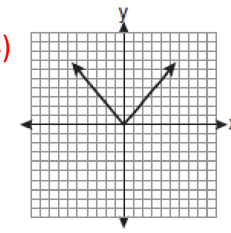
(4) $\{(-1,2),(0,5),(5,0),(2,-1)\}$

35. Which graph represents a function?

(1) 

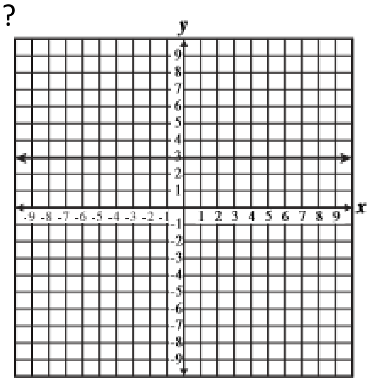
(2) 

(3) 

(4) 

(4) The graph passes the vertical line test (when a vertical line passes through the graph, it touches the graph only in one place).

36. The accompanying figure shows the graph of which equation?



(1) x = 3

(2) y = x + 3

(3) y = 3

(4) x = 0

(3) y = 3
The equation of a horizontal line is **y = b**, where **b** represents the y-intercept. This graph intercepts the y-axis at 3. Choice (1) x = 3 is a picture of a vertical line that intercepts the x-axis at 3.

37. Which equation represents a line that is parallel to the line whose equation is **2x + 3y = 12**?

(1) 6y – 4x = 2

(2) 6y + 4x = 2

(3) 4x – 6y = 2

(4) 6x + 4y = -2

2x + 3y = 12 Rewrite in y = mx + b form
3y = -2x + 12

$$y = -\frac{2}{3}x + 4$$

Parallel lines have the same slopes and different y-intercepts. Put all the equations in y = mx + b form and analyze the slopes and y-intercepts.

(2) 6y + 4x = 2
6y = -4x + 2

$y = -\frac{2}{3}x + \frac{1}{3}$ same slope as 2x + 3y =12 but different y-intercept.

38. What are the coordinates of the x-intercept of the line **3x + 4y = 12**?

(1) (0,3)

(2) (0,4)

(3) (3,0)

(4) (4,0)

x-intercept (x, 0) **(4) (4,0)**
3x + 4y = 12
3x + 4(0) = 12
3x + 0 = 12
3x = 12
x = 4

39. Mr. Rich recently planted three apple trees in his garden. Consider the growth patterns of each tree represented by A, B and C. **Create a growth equation for each tree.**

A: The first tree was five inches tall when planted. It has grown four inches every month since being planted.

Tree A: Growth Equation **y = 4x + 5**

y-intercept: **5** the tree is 5 inches tall when planted (starting height)
ROC (m): **4** grows 4 inches per month

B: Measurements were taken of the second tree and are displayed below in the table.

Months	0	2	3	5
Height	3	12	16.5	25.5

Rate of Change (0,3) (2,12)

$$\frac{\Delta y}{\Delta x} = \frac{12-3}{2-0} = \frac{9}{2} = 4.5$$

Tree B: Growth Equation **y = 4.5x + 3**

y-intercept: 3 (0,3) starting height
ROC (m): 4.5 grows 4.5 inches per month

C: The growth pattern of the third tree is modeled by the graph below.

Tree C: Growth Equation **y = 3.5x + 10**

y-intercept: 10 (0,10) starting height
ROC (m): 3.5 grows 3.5 inches per month

Rate of Change (0,10) (2,17)

$$\frac{\Delta y}{\Delta x} = \frac{17-10}{2-0} = \frac{7}{2} = 3.5$$

Based on the information above, complete a – c.

a) Which of the trees is growing the fastest? Justify your response.

Compare the rates of change (m) of each growth equation. **Tree B** is growing at the fastest rate because the growth equation displays the greatest rate of change. Tree B grows 4.5 inches per month as compared to trees A and C which grow 4 in per month and 3.5 in per month respectively.

b) Which tree was the tallest when it was first planted?

Compare the y-intercepts (b) of each growth equation. **Tree C** was the tallest when it was first planted. It was 10 inches in height as compared to the starting heights of 5 and 3 inches.

c) Which tree is the tallest after 6 months?

Replace x with 6 in each growth equation or look at a table of values on the calculator.

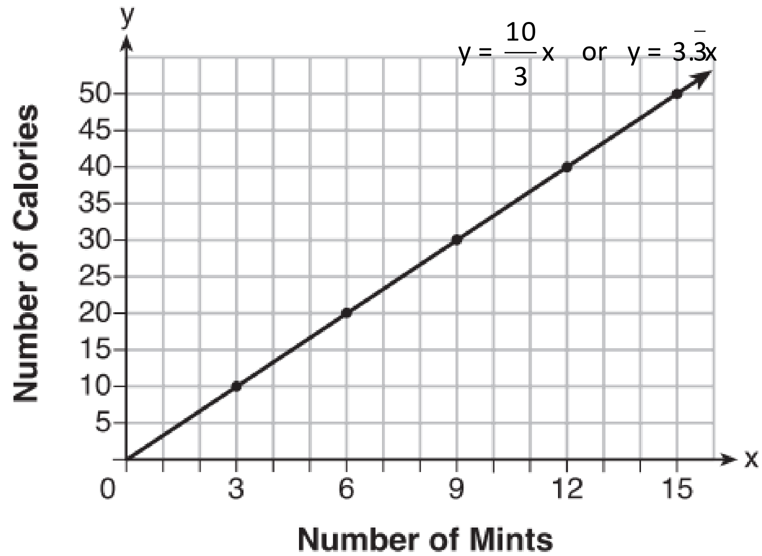
X (# of months)	Y_1 (TREE A HEIGHT)	Y_2 (TREE B HEIGHT)	Y_3 (TREE C HEIGHT)
6	29	30	31

Tree C is the tallest after 6 months. The tree is 31 inches tall.

40. Max purchased a box of green tea mints. The nutrition label on the box stated that a serving of three mints contains a total of 10 calories.

a) On the axes below, graph the function that represents the relationship described above.
Create a table that represents the situation.

Mints (x)	Calories (y)
0	0
3	10
6	20
9	30
12	40
15	50



b) Write an equation that represents the graph.

y-int: 0

slope (*rate of change*): $\frac{\Delta y}{\Delta x} = \frac{10-0}{3-0} = \frac{10}{3}$ $\quad m = \frac{10}{3}$ $\quad b = 0$ $\quad \mathbf{y = \frac{10}{3}x + 0} \rightarrow \mathbf{y = \frac{10}{3}x}$

Check equation with the table of values. The equation should represent the values in the table above.

c) A full box of mints contains 180 calories. Use the equation to determine the total number of mints in the box.

$y = \frac{10}{3}x$ → **x**: # of mints, **y**: # of calories

$180 = \frac{10}{3}x$

$\frac{3}{10} \bullet 180 = \frac{\cancel{10}}{\cancel{3}} \bullet \frac{\cancel{3}}{\cancel{10}}x$

$54 = x$

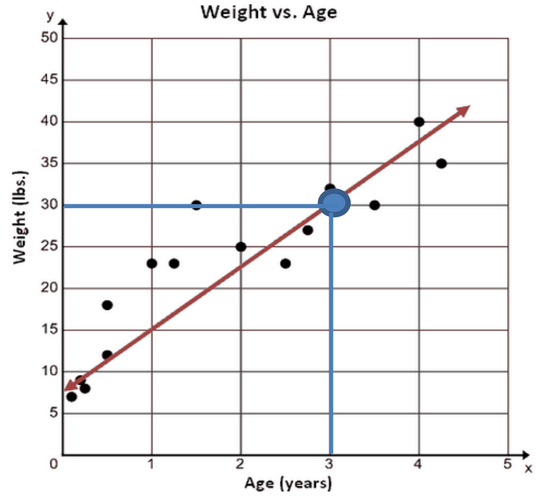
There are a total of 54 mints in the box.

Calculator Check

1) Enter y = (10/3)x into y_1
2) Go to table of values

x	Y_1
54	180

41. Examine the graph pictured below which compares the age of a child and his/her corresponding weight.



a) According to the regression line, what is the expected weight of a child who is 3 years old?

30 lbs (*see graph to the right*)

b) The value of the y-intercept of the line of best fit is 8. Explain its meaning in the context of the situation.

Based on the trend line, the *approximate* weight of a baby when it is born is 8 lbs.

42. Which correlation coefficient indicates that a linear function would *not* be a good fit to model a data set?

(1) r = -0.93

(2) r = 1

(3) r = -1

(4) r = 0.24

(4)
The correlation coefficient indicates that the data is randomly dispersed and doesn't form a linear pattern. There is no correlation that can be determined between the two variables.

(1) A correlation coefficient close to -1 indicates a pattern of data that seems to form a line with a negative slope.

(2) A correlation coefficient of 1 indicates that the data forms a perfect straight line with a positive slope.

(3) A correlation coefficient of -1 indicates that the data forms a perfect straight line with a negative slope.

43. Emma recently purchased a new car. She decided to keep of track of how many gallons of gas she used on five of her business trips. The results are shown in the table below.

Miles Driven	Number of Gallons Used
150	7
200	10
400	19
600	29
1000	51

a) Write the linear regression equation for these data where miles driven is the independent variable (*Round all values to the nearest hundredth*).

$y = 0.05x - 0.92$

Calculator

1) STAT Edit (#1) **2)** Enter data into L_1 and L_2 **3)** STAT $\longrightarrow$ CALC #4 LinReg($ax + b$)

a = .05131… b = -.91945… *See Flip Video #6 for calculator assistance.*

b) Emma plans to take a business trip next week that requires her to drive 850 miles. Using your regression equation, predict the number of gallons of gas Emma will use to the nearest whole.

x: miles
y: gallons of gas

$$y = 0.05x - 0.92$$
$$y = 0.05(850) - 0.92$$
$$y = 42.5 - 0.92$$
$$y = 41.58$$

We predict Emma will use about 42 gallons of gas on her trip.

c) Using the linear regression equation, estimate the number of miles, to the nearest whole, Emma drove if she used 23 gallons of gas.

x: miles
y: gallons of gas

$$y = 0.05x - 0.92$$
$$23 = 0.05x - 0.92$$
$$23.92 = 0.05x$$
$$x = 478.4$$

We estimate Emma will have driven 478 miles.

44. On the set of axes below, draw the graph of the equation $y = -\frac{3}{4}x + 1$ defined over the domain $-8 \leq x \leq 8$. State the range of the function.

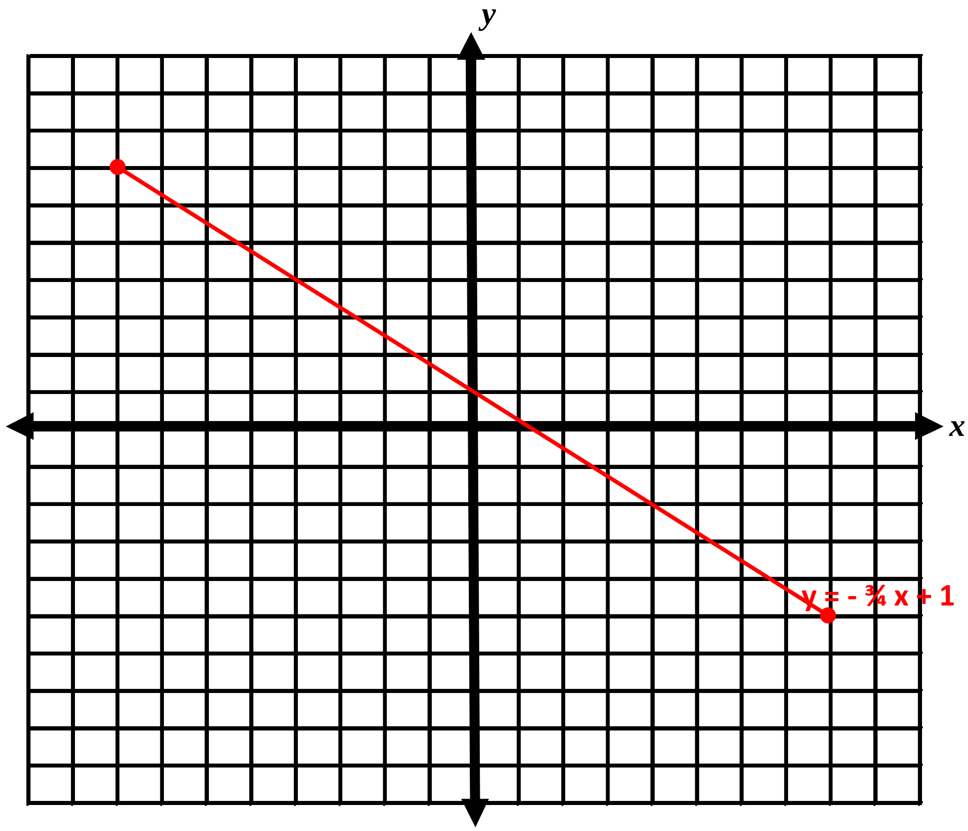
x	y
-8	7
-4	4
0	1
4	-2
8	-5

Domain: Use *x*-values that range from -8 to positive 8.

Range:
The set of *y*-values that range from -5 to 7, including -5 and 7.

{$-5 \leq y \leq 7$} *inequality statement*

[-5, 7] *interval notation*



45. To thaw a specimen stored at -25 ^{o}C, the temperature of a refrigeration tank is raised every hour. The temperature in the tank after **x** hours can be described by the function **y = -25 + 5x**.

a) Identify the y-intercept of the function. Describe its meaning.

The y-intercept is -25. Before any time has passed, the temperature of the refrigeration tank is -25 ^{o}C. The starting temperature of the refrigeration tank is -25 ^{o}C.

b) Identify the rate of change of the function. Describe its meaning.

The rate of change is 5. Every hour, the temperature of the refrigeration tank is raised 5 ^{o}C.

$$\frac{\Delta y}{\Delta x} = \frac{\text{temperatue}}{\text{hour}} = \frac{5}{1}$$