Grade 7

Units 5-7

Unit 5: Proportional Relationships

Unit 6: Ratio and Rates

Unit 7: Percent

Name: _____

Teacher: _____

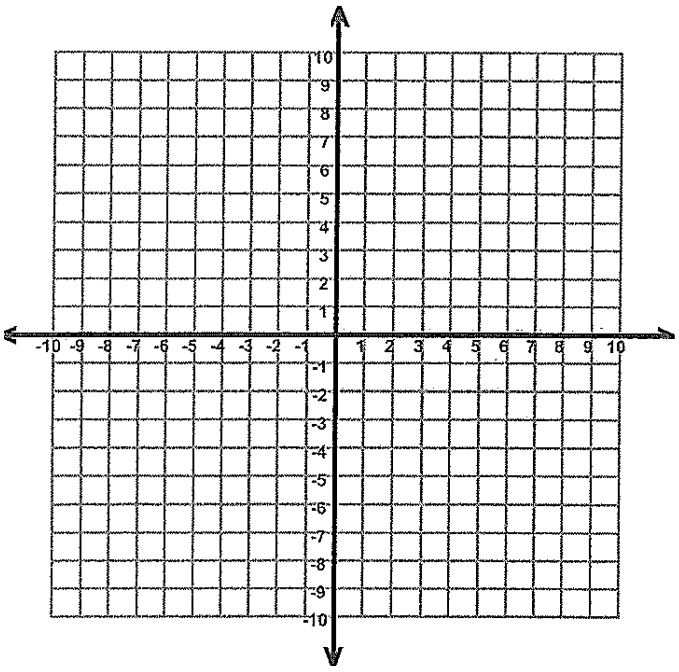
Period: _____

Unit 5

Proportional Relationships

Date	Lesson	Topic
	1	Proportional Relationships with **Tables**
	2	Proportional Relationships with **Graphs**
	3	Equations with Tables and Graphs
	4	Interpreting Graphs
		Extra Day
		Review
		Test

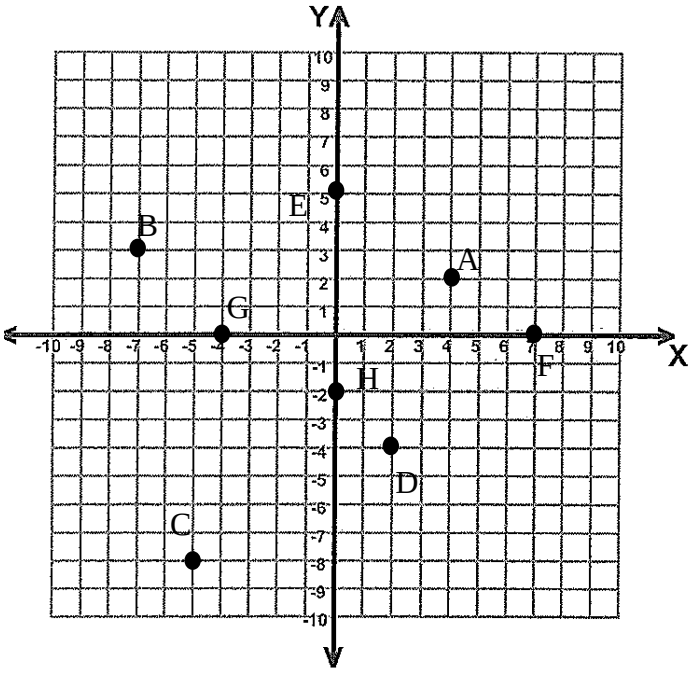
REVIEW OF PLOTTING POINTS

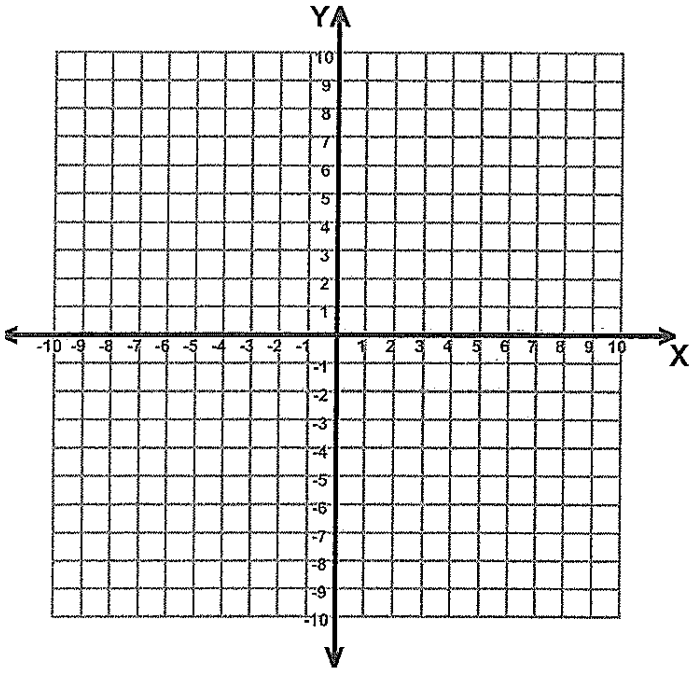


Label:

1) x - axis
2) y - axis
3) Origin (0,0)
4) Quadrants (I, II, III, IV)

Remember: A point is always written (x, y)





Name each of the following points.

A _____ E _____

B _____ F _____

C _____ G _____

D _____ H _____

Plot each of the following points and label. Name the Quadrant that the point is in.

J (3, 5) N (7, 0)

K (-4, 2) P (0,0)

L (-3, -6) Q (-9, 0)

M (7, -2) R (0, 4)

Lesson 1
Proportional Relationships (With Tables)

Vocabulary:

Constant of Proportionality - A constant ratio (unit rate) of two variable quantities.

$$k = \frac{y}{x} \quad \text{or} \quad y = kx$$

Proportional Relationship (Directly Proportional) – Two quantities are proportional if they have a constant ratio (k) or unit rate. As one variable increases, the other variable increases by the SAME RATE.

Ways to check for a Proportional Relationship in a Table:

1) Quantities must have equivalent ratios. If you divide y by x, the constant (k) should be the same for the entire table of values.
2) Their cross products are equal.

Examples:

Are the following tables proportional?

1)

X	Y
2	8
4	16
6	24

Proportional? Yes or No

If yes, what is the constant, k?

2)

X	Y
3	9
4	12
5	20

Proportional? Yes or No

If yes, what is the constant, k?

3)

X	Y
5	1
10	2
15	3

Proportional? Yes or No

If yes, what is the constant, k?

Using a Ratio to Identify a Unit Rate

4)

X Hour	Y $
3	90
4	120
6	180

Proportional? Yes or No

If yes, what is the Unit Rate ($ per hour)?

5)

X Hour	Y Miles
1	30
2	60
3	120

Proportional? Yes or No

If yes, what is the Unit Rate (Miles per hour)?

6) Gas Mileage

X - Gallons of gas used	10	15	20
Y - Miles	200	300	400

Proportional? yes/no

If yes, what is the Unit Rate (miles per gallon)?

7) Cooking Times

X - Cooking Time (hour)	4	3.5	2.5
Y - Weight of Turkey(lb)	16	14	10

Proportional? yes/no

If yes, what is the Constant K (lb per hour)?

The following tables are PROPORTIONAL, find the Unit Rate and Missing Values.

8) Babysitting Pay

X- Hours (h)	2	10	16
Y- Pay (p)	$11	$55	

Unit Rate (in words) _____

Unit Rate: _____

9) Dog Biscuits

X - Biscuits (lb)	3	10	12	
Y - Price	$1.65	$5.50		$9.90

Unit Rate (in words) _____

Unit Rate: _____

Try These:

1) Paint Coverage

X Amount of Paint (gallons)	Y Area Covered (square feet)
.5	2,000
.75	3,000
3	12,000
4.5	18,000

Proportional? yes/no

If yes, what is the Unit Rate (Square ft per gallon)?

2) Grapes per pound

X Grapes (pound lb)	Y Cost (per lb)
5	$6.00
3	$3.60
1/4	$1.20

Proportional? yes/no

If yes, what is the Constant K?

The following tables are PROPORTIONAL, find the Unit Rate and Missing Values.

3) Texting Prices

# of texts	200	300	50	
Pay ($)	$150	$225		$18.75

Unit Rate (in words) _____

Unit Rate: _____

4) Calories burned for 130 lb. woman running 5 mph

Length of workout (hours)	.5	.75	.25	
Calories burned	236	354		1,416

Unit Rate (in words) _____

Unit Rate: _____

Determine whether each table forms a proportional relationship.

1)

x	1	2	4	7	9
y	5	9	17	29	37

Proportional? yes or no

If yes, what is the Constant K?

2)

x	2	4	6	8	10
y	1.5	3	4.5	6	7.5

Proportional? yes or no

If yes, what is the Constant K?

3)

x	y
1	3
2	6
3	9
4	12

Proportional? Yes or No

If yes, what is the Constant K?

4)

x	y
2	3
3	5
4	7
5	9

Proportional? yes or no

If yes, what is the Constant K?

5)

x	1	2	3	4	5
y	2	8	16	32	64

Proportional? yes or no

If yes, what is the Constant K?

6)

x	1	3	5	7	9
y	$\frac{7}{2}$	$\frac{21}{2}$	$\frac{35}{2}$	$\frac{49}{2}$	$\frac{63}{2}$

Proportional? yes or no

If yes, what is the Constant K?

The following tables are directly proportional:
Find the constant of proportionality and use it to complete the tables:

7) Travel Speed

Time (min)	0	20	40	60	
Distance (mi)	0	15	30		60

8) Interest on Savings

Amount Saved (s)	200	350		750	
Interest Earned ($)	8	14	20		36

9) The Smith's are going on a family road trip. The table below shows the distance traveled over the course of the first 5 hours of the trip.

Hours	1	2	3	4	5
Distance	65	130	130	195	260

a) Is the distance traveled proportional to the time traveled?_____

b) What could be the reason for why the family's distance stayed the same between the second and third hours of the trip?

_____

_____

Lesson 2
Proportional Relationships with Graphs

Do Now – Which of the following tables represents a proportional relationship?

A)

x	2	4	6
y	1	2	4

B)

x	2	4	6
y	4	5	6

C)

x	2	4	6
y	3	5	7

D)

x	2	4	6
y	5	10	15

Vocabulary:

Unit Rate: _____

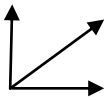
Constant of Proportionality ($y = \underline{\boldsymbol{k}}x$): _____

Origin: _____

***Proportional relationships can be represented on a coordinate plane.**

A GRAPH SHOWS A PROPORTIONAL RELATIONSHIP WHEN:

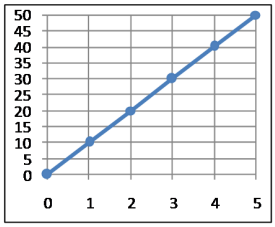
1. THE LINE GOES THROUGH THE ORIGIN (0,0)
2. THE LINE IS STRAIGHT



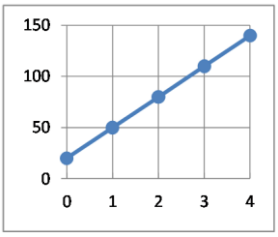
Examples:

Determine if each of the following shows a proportional or nonproportional relationship, and explain:

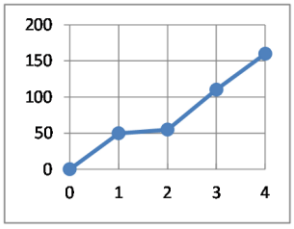
1)



2)



3)



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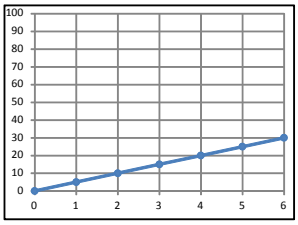
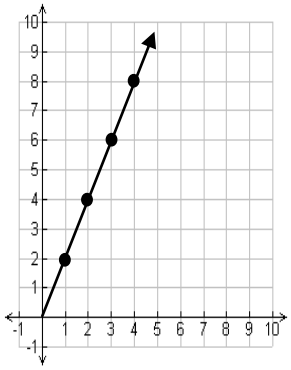


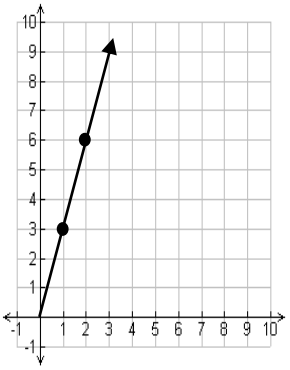
Do the following graphs show a proportional relationship? If so, find the Unit Rate (Constant).

5)



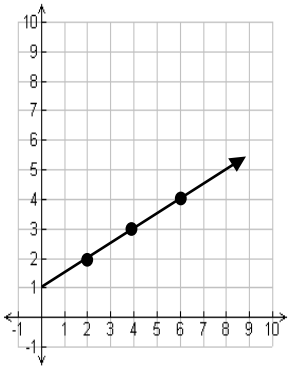
Yes/No Unit rate: _____

6)



Yes/No Unit rate: _____

7)

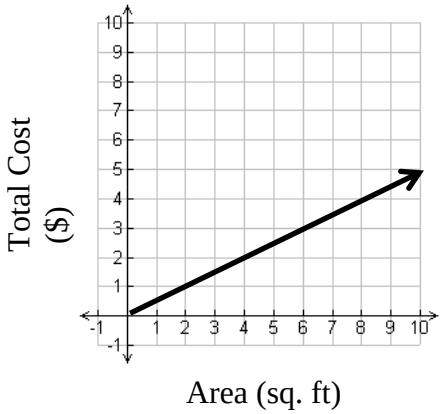


Yes/No Unit rate: _____

Graphical Representations of Real-Life Situations

Determine whether each graph is proportional.

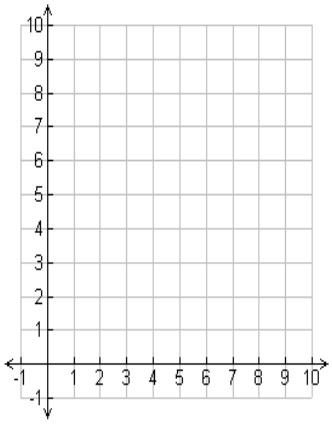
8)



Yes or No- Justify_____

If yes, what is the unit rate? _____

9) (0,4), (1,6), (2,8), (3,10)



Yes or No- Justify_____

If yes, what is the unit rate? _____

---

10) The graph shows the relationship between the time it takes a turtle to walk and its distance.

a. What is the title of the graph?

b. What is the label of the x-axis?

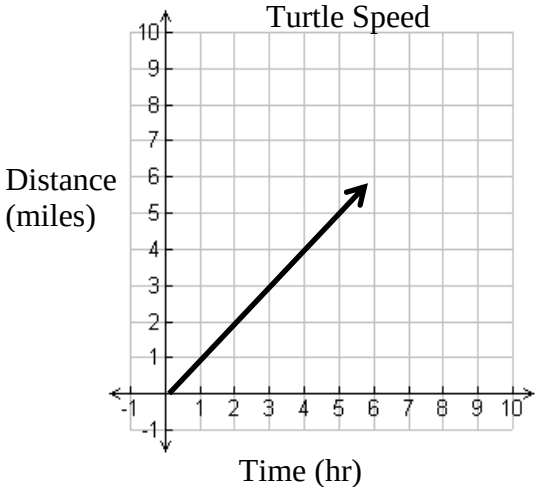
c. What is the label of the y-axis?

d. According to the graph, how far does the turtle travel in 3 hours?

e. According to the graph, how long does it take the turtle to travel 5 miles?

f. What does the point (4, 4) on the line represent?

g. What is the unit rate (1,*r*)? _____



Since this graph goes through the origin and the unit rate is constant, it is a proportional relationship.

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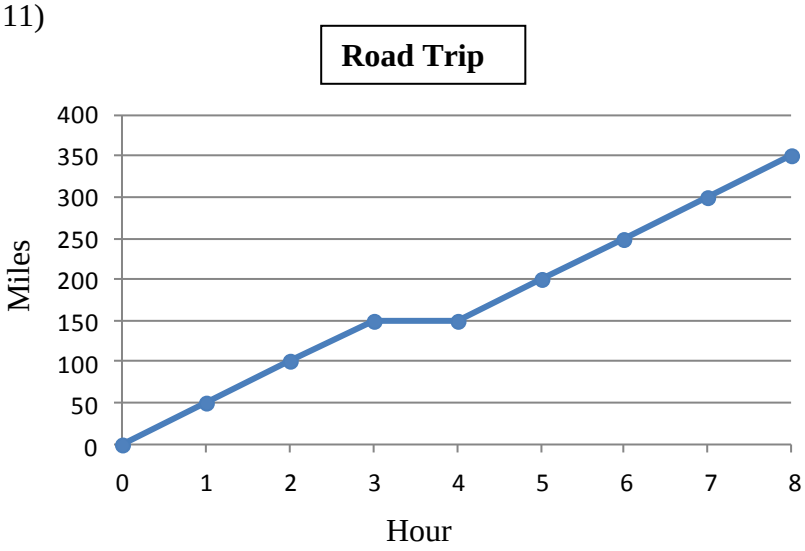
11)



a) Is the graph showing a proportional relationship?

b) Speculate what might have happened during the 3rd and 4th hour of the trip.

c) What is the average speed from hour 1 to hour 3?

d) What is the average speed for the entire trip?

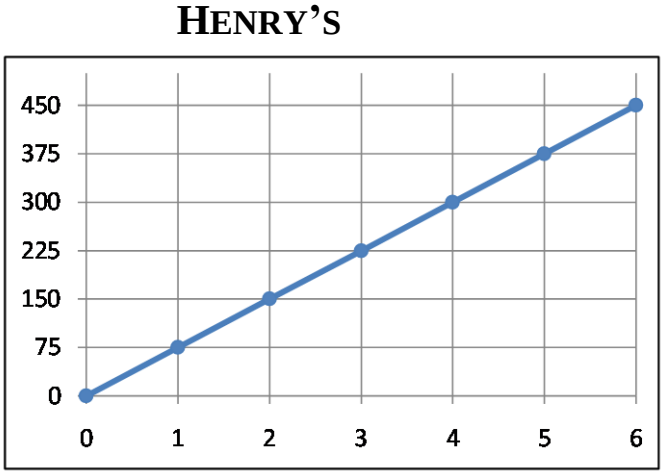
---

12) Henry's Earnings are proportional to the number of hours he works, the graph represents his earnings.

1. How much money does Henry make per hour?

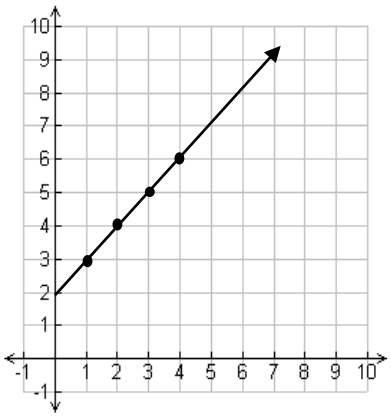
2. How long would it take Henry to make at least $200?

3. Use a proportion to determine how much money Henry would earn in 8 hours.



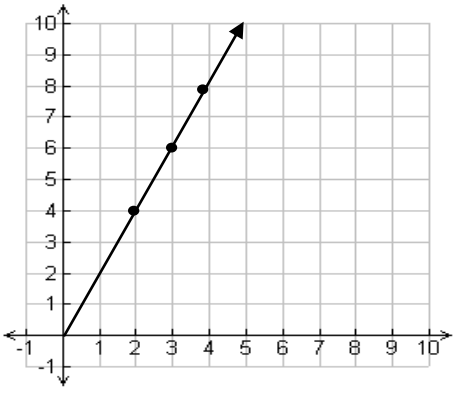
Try These:

1)



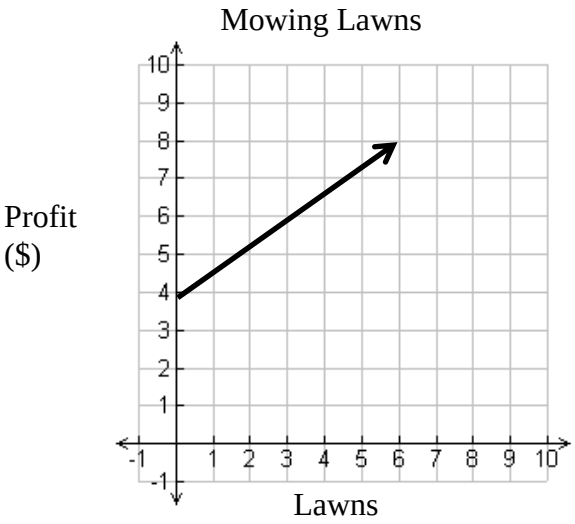
Proportional? Yes or No
If so, what is the unit rate? _____

2)



Proportional? Yes or No
If so, what is the Constant? _____

3)

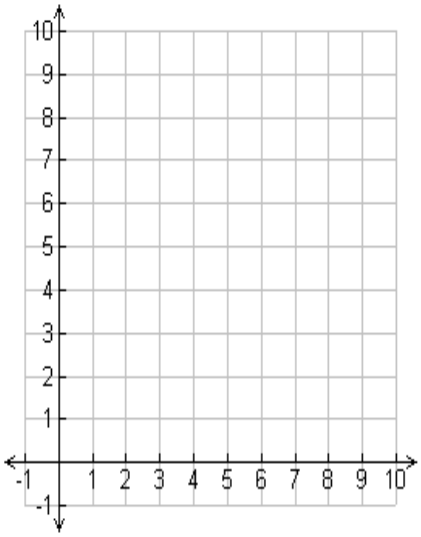


Proportional? Yes or No

Justify_____

_____

4) (0,0), (1,2), (2,4), (3,6)

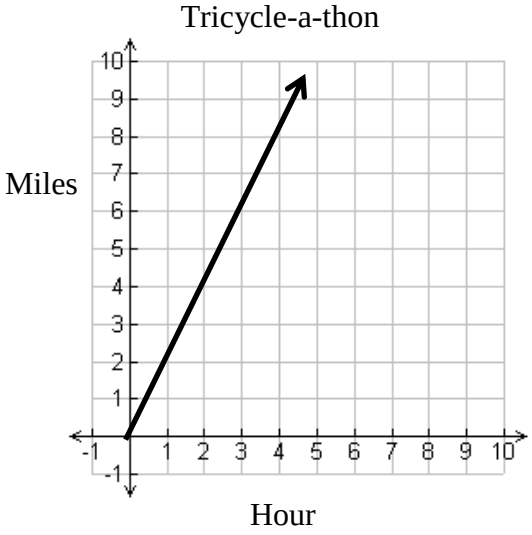


Proportional? Yes or No

Justify_____

_____

5) The graph shows distances traveled for a bike-a-thon.

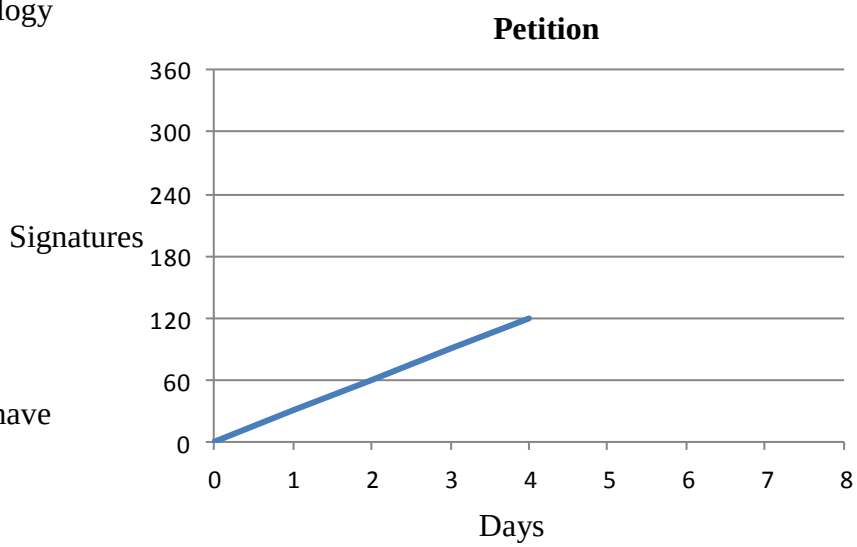


What is the unit rate? (miles per **hour**)

_____

How many miles does the participant ride in 11 hours?

6) A student trying to save the Holtsville Ecology site was getting signatures on a petition.



a. What is the unit rate? (signatures per day)

b. At this rate, how many signatures will he have in *1 week?*

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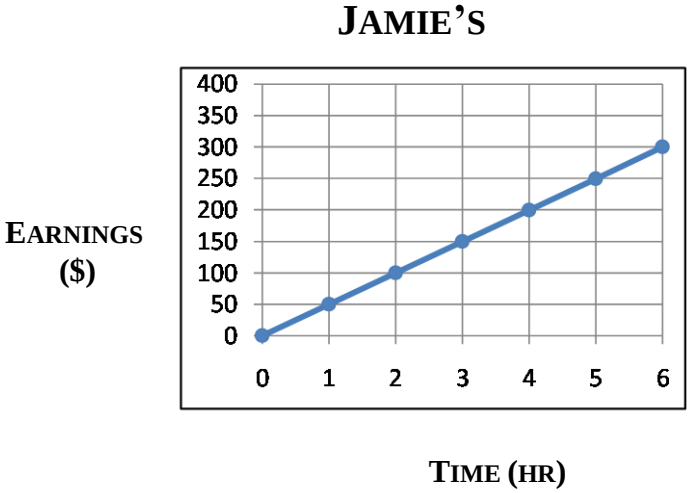
7) Jamie's Earnings are proportional to the number of hours she works, the graph represents her earnings.



How much money does Jamie make per hour?

How long would it take Jamie to make $300?

Use a proportion to determine how much money Jamie would earn in 12 hours.

Use a proportion to determine how many hours it would take Jamie to earn $500?

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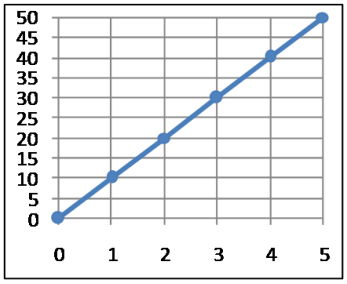
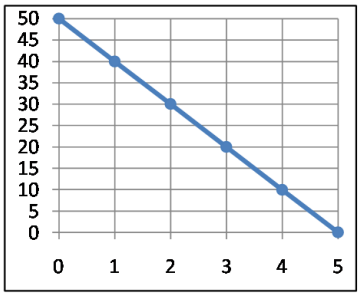
1) Determine if each of the following shows a proportional or non-proportional relationship, and explain. If it shows a proportional relationship, find the Unit rate.

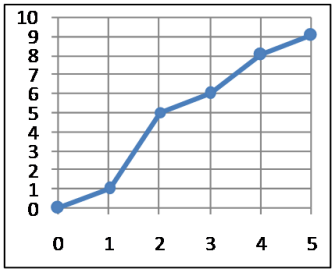
a.



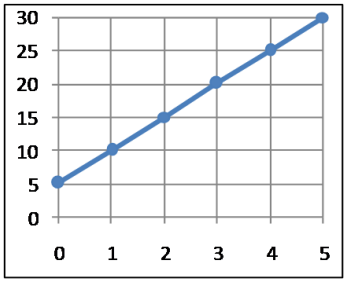
b.



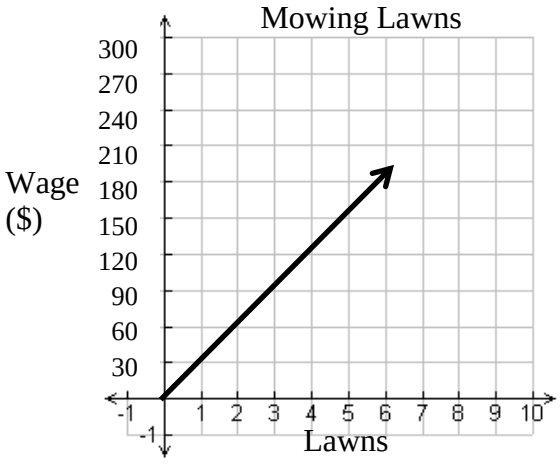
c.



d.



2) The graph shows your wages for mowing lawns during the summer.



What is the unit rate? ($ per lawn)

_____

How many lawns will you mow if you earned $390?

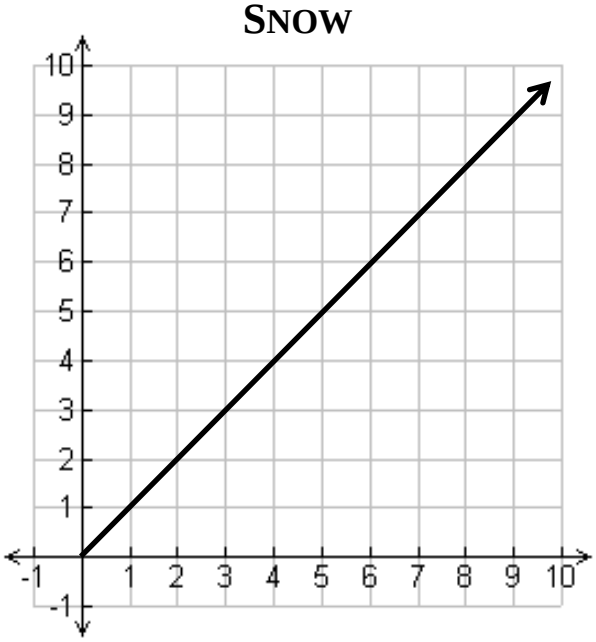
3) Robert shovels driveways after a snow storm. The graph to the right represents the situation.

What does the line represent?

How many driveways does Robert shovel per hour?

After 3 hours, how many driveways will Robert have shoveled?

Robert charges $60 per driveway shoveled. How much money will he make if he shovels for six hours?



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4) A student is making trail mix.

A) Create a graph, using the coordinate plane below, to determine if the quantities of nuts and fruit are proportional in the table.

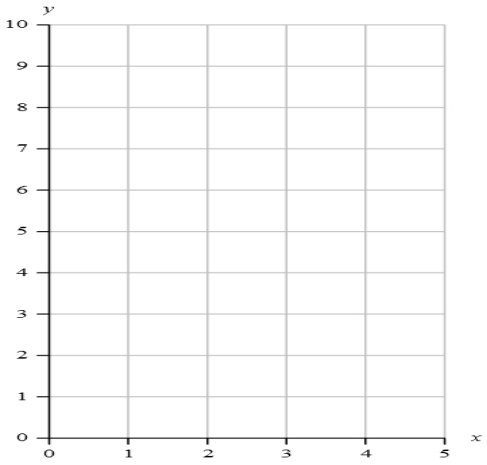
Label the axes and title your graph

Cups of Nuts (x)	Cups of Fruits (y)
1	2
2	4
3	6
4	8

B) If the quantities are proportional, what is the constant of proportionality (unit rate) that defines the relationship?

C) Explain how the constant of proportionality was determined and how it relates to both the table and graph.

D) What does the point (1, 2) mean in regards to the situation?



Lesson 3
Equations with Graphs & Tables

Find the Constant and Write the Formula $y = kx$

When the ratios of two quantities are always the same, the quantities are proportional. The value of the ratio is called the constant of proportionality (k). This value is also equivalent to the unit rate.

Constant of Proportionality is the same as unit rate.

$$k = \frac{y}{x}$$

$y =$ _____x
_____ is the constant of proportionality.

Examples:
Complete the following tables. Using the table of values, write the equation on the line.

1)

X	Y
3	6
4	8
5	10
6	12
7	14
8	16
9	
10	

_____

2)

X	Y
1	10
2	20
3	30
4	40
5	50
6	60
7	
8	

_____

3)

X	Y
2	6
3	9
4	12
5	15
6	18
7	21
8	
9	

_____

$$k = \frac{y}{x}$$

Find the constant of proportionality for each table/graph and write the equation.
Identify the constant *Hint: Circle the word after the word "per" because that is your x (input).

4) yards of cloth per *blanket*

Yards (y)	16	32	40
Blankets (b)	8	16	20

Constant of proportionality (k) = _____

Equation: _____

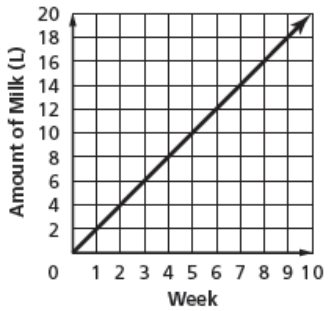
5) pay per *hour*

Hours (h)	2	10	16
Pay (p)	$11	$55	$88

Constant of proportionality (k) = _____

Equation: _____

6)



Constant of proportionality (k) = _____

Equation: _____

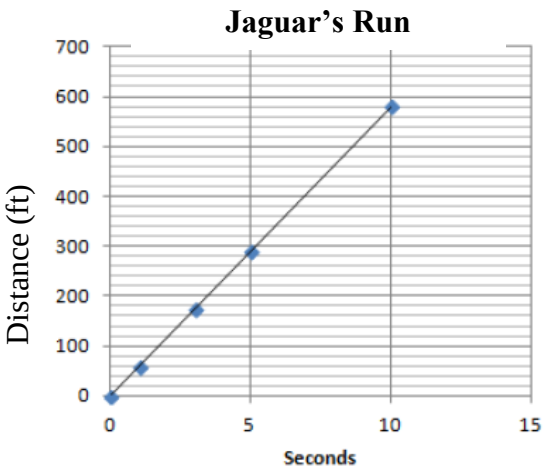
7) The graph to the right shows the distance (in ft.) ran by a Jaguar.

a) What does the point (5, 280) represent in the context of the situation?

b) What does the point (3, 168) represent in the context of the situation?

c) Is the distance run by the Jaguar proportional to the time? Explain why or why not.

d) Write an equation to represent the distance ran by the Jaguar. Explain or model your reasoning.



Find the constant of proportionality in the chart and graph below. Next, write the equation for the situation.

8) Find the constant of proportionality. y/x

Write the equation that satisfies this table.

x	y
0	0
1	3
2	6
3	9

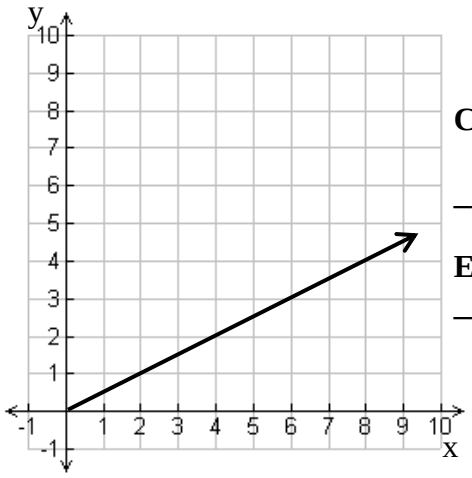
$\frac{y}{x} = k$,

Then write your equation as

y = ___ x

9) Find the constant of proportionality. y/x

Write the equation that satisfies this graph.



Constant _____

Equation _____

Try These:

Find the constant of proportionality (unit rate) in each of the relationships that follow:

1) y = 3x

k = _____

2) $y = \frac{1}{3}x$

k = _____

3) y = x

k = _____

4) $y = \frac{3}{2}x$

k = _____

Complete the following tables. Using the table of values, write the equation on the line.

5)

X	Y
2	10
3	15
4	20
5	25
6	30
7	35
8	
9	

_____

6)

X	Y
6	3
8	4
10	5
12	6
14	7
20	
30	

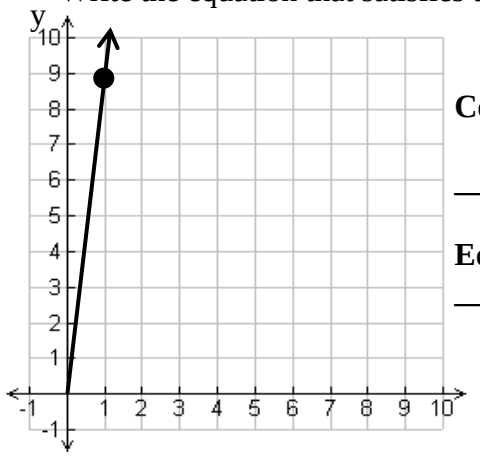
_____

7) Find the constant of proportionality. y/x

Write the equation that satisfies this table. Before you begin, which value do you think is the output (y)?

Hours (h)	2	10	24	40
Pay (p)	$16	$80	$192	$320

8) Find the constant of proportionality.
Write the equation that satisfies this graph.



Constant

_____

Equation

_____

9)

Find the constant of proportionality. y/x
Write the equation that satisfies this table.

x	y
0	0
1	4
2	8
3	12

— = k,

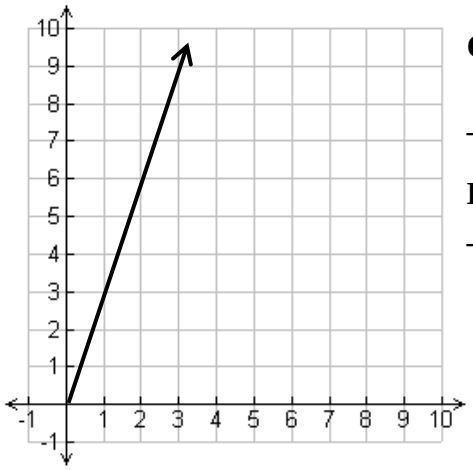
↓

Then write your equation as

y = ___ x

10)

Find the constant of proportionality. y/x
Write the equation that satisfies this graph.



Constant

_____

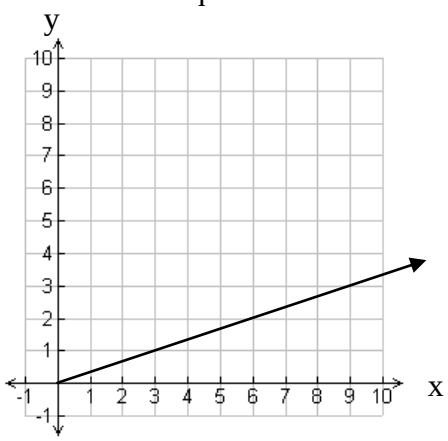
Equation

_____

11) Find the constant of proportionality. Write the equation that satisfies this table. Before you begin, which value do you think is the output?

Hours (h)	2	10	24	40
# of rooms painted (p)	1.5	7.5	18	30

12) Find the constant of proportionality.
Write the equation that satisfies this graph.



Constant

_____

Equation

_____

13) If the constant of proportionality is 3.5, what is the equation?

14) A truck driver has travelled 350 miles in 5 hours. Write an equation that represents his distance travelled per hour.

15) The cost of a certain vegetable is 0.59 per pound. Write an equation to represent this situation, using *c* to represent the cost and *p*, for pounds.

16) The new data plan offers 2MB of data for $30. Write an equation to represent this situation, using *c* to represent the cost and *d*, for data.

***K* = constant of proportionality** y/x

Find the Constant (unit rate) and Write the Formula *y = kx*

1) wages per day

Days (*d*)	**5**	**10**	**15**
Wages (*w*)	**$51.25**	**$102.50**	**$153.75**

Constant of proportionality (*k*) = _____

Equation_____

2) price per pound

Pounds	**4**	**5**	**6**
Price	**$7.96**	**$9.95**	**$11.94**

Constant of proportionality (*k*) = _____

Equation_____

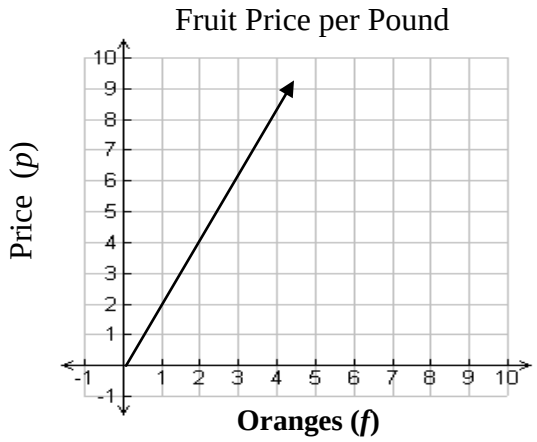
3) pounds per bag

Bags (*b*)	3	8	11
Dog Food (lb) (*d*)	7.5	20	27.5

Constant of proportionality (*k*) = _____

Equation_____

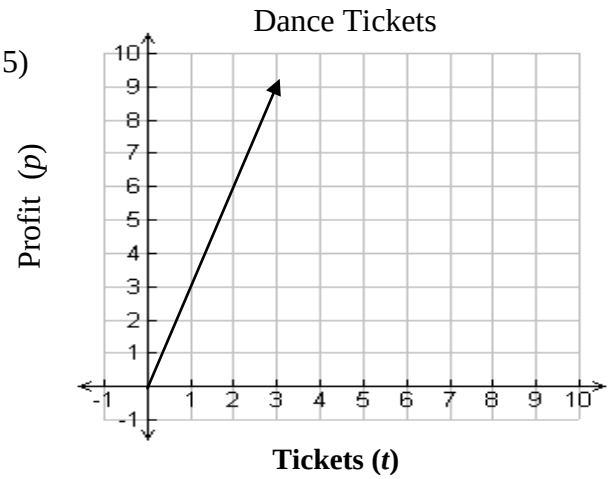
4)



Constant of proportionality (*k*) = _____

Equation_____

5)



Constant of proportionality (*k*) = _____

Equation_____

6) A bakery can produce 120 cookies for every 3 hours. What is the constant of proportionality? What is the equation that represents this situation?

7) The following table shows the amount of candy and price paid.

Amount of Candy (pounds)	2	3	5
Cost (Dollars)	5	7.5	12.5

a) Is the cost of candy proportional to the amount of candy?

b) Write an equation to illustrate the relationship between the amount of candy and the cost. _____

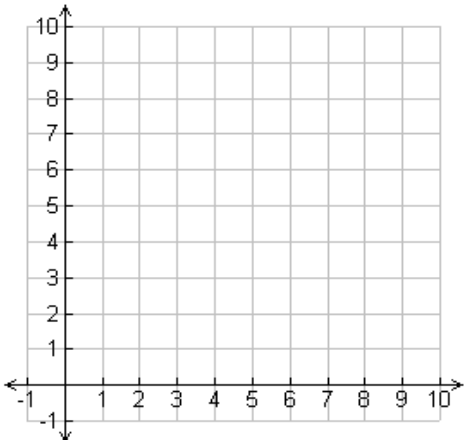
c) Using the equation, predict how much it will cost for 12 pounds of candy?

d) What is the maximum amount of candy you can buy with $60?

8) Plot the following points on a coordinate grid.
(2,2), (4,4), (6,6), (8,8)

Find the constant of proportionality ____

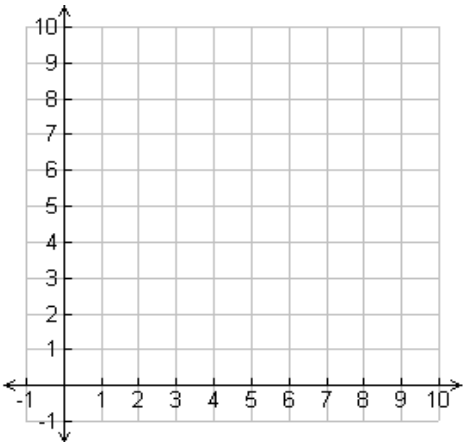
What is the equation?_____



9) Plot the following points on a coordinate grid.
(3,1), (6,2), (9,3)

Find the constant of proportionality ____

What is the equation?_____



10) Create a real-life question that has a constant of proportionality that is a whole number. Be sure to write the equation and explain what it means.

11) Create a real-life question that has a constant of proportionality that is a fraction. Be sure to write the equation and explain what it means.

Lesson 4
Interpreting Graphs

Remember back on day 1 of this Unit, you were told you would be able to tell if something formed a proportional relationship, what the constant of proportionality is, and how to graph and write an equation.

Examples:

1) Hailey works for Cake Boss making brownies all day. She can bake 6 batches of brownies in 3 hours.

a) Find the constant of proportionality.

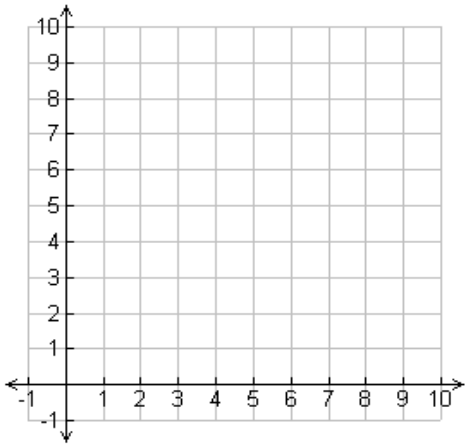
b) Fill in the table below:

Hours(h)	0	1	4	10
Batches(b)				

c) Write an equation to represent this situation.

d) Graph this situation in the graph on the right. Be sure to label your axes for batches and for hours. Be sure to title your graph.

d)



2) Last summer, a family took a trip to a beach that was about 200 miles away from their home. The graph to the right shows the distance driven, in miles, and the time, in hours, taken for the trip. Show all work.

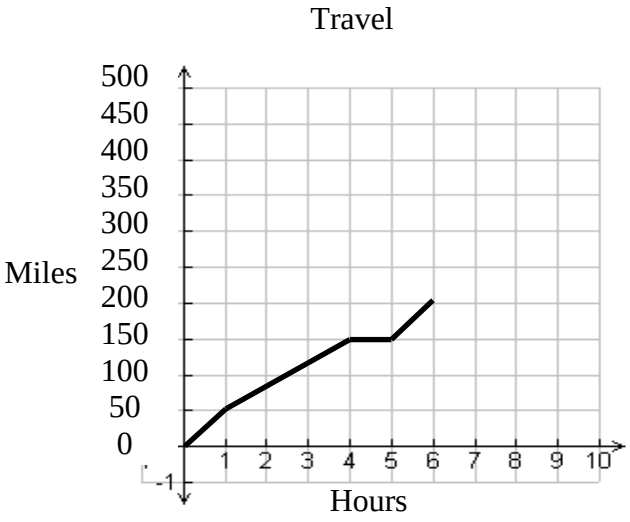
What was their average speed from hour 1 to hour 4?

a) 25 miles per hour

b) $33\frac{1}{3}$ miles per hour

c) $66\frac{2}{3}$ miles per hour

d) 100 miles per hour



Try These:

1) Spencer rides his bicycle for 10 hours. He can bike 25 miles in 2 hours.

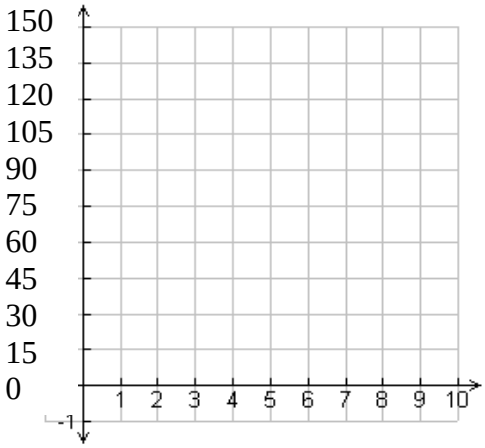
a) Find the constant of proportionality.

b) Fill in the table below:

Hours	0	1	4	10
Distance				

c) Write an equation to represent this situation.

d) Graph this situation in the graph on the right. Be sure to label your axes with miles and for hours. Be sure to title your graph.



2) At NASA, a rocket was test fired. The graph to the right shows the distance risen and fallen, in miles, and the time, in minutes, taken for the trip. Show all work.

a) What was the rockets average speed from minute 0 to minute 3?

b) What happened between minute 3 through minute 6?

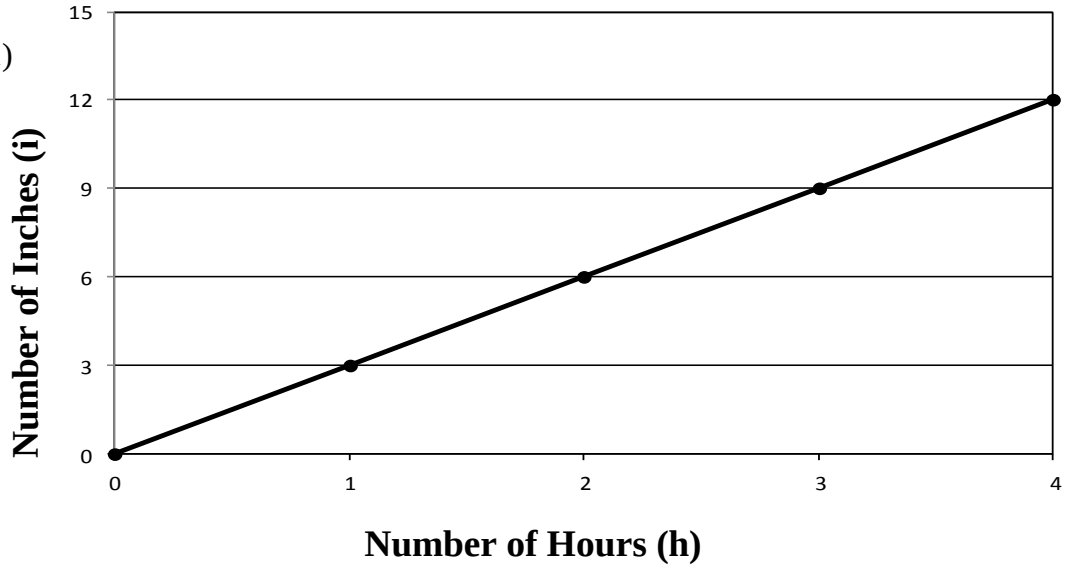
c) During what minutes did the rocket descend?

d) What was the rockets average rate of descent?

3) What does the points (0,0) and (1, r) represent on a graph?

4) Define the constant of proportionality in your own words.

1)



1) Explain what the point (2, 6) means in reference to the graph.

2) Explain what (0, 0) means.

3) Explain what (1, r) means where r is the unit rate.

4) This summer, Maggie would like to start saving money. Maggie is planning on working all 10 weeks of the summer. She saves $20 every two weeks.

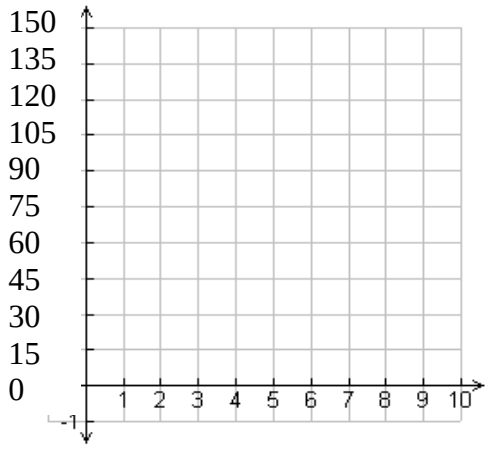
a) Find the constant of proportionality.

b) Fill in the table below:

Weeks	0	1	7	10
Savings				

c) Write an equation to represent this situation.

d) Graph this situation in the graph on the right. Be sure to label your axes with weeks and savings. Be sure to title your graph.



5) Fill in the blanks:

Weeks	0	1	5	10
Savings			35	

6) A boy scout convention takes a road trip. There are 282 people going and only 47 cars. How many people will need to fit in each car?

7) One day you download 4 songs for $5. Write an equation that uses the constant of proportionality to describe the relationships between s songs and the cost in d dollars.

8) Last month the electric bill was $50.64 for 450 kilowatt-hours of electricity. At that rate, what would be the cost for 240 kilowatt-hours?

9) Make up your own proportional relationship.

- Create a table
- Create a graph
- State the unit rate
- Write situation in words
- Write an equation to represent the constant of proportionality.

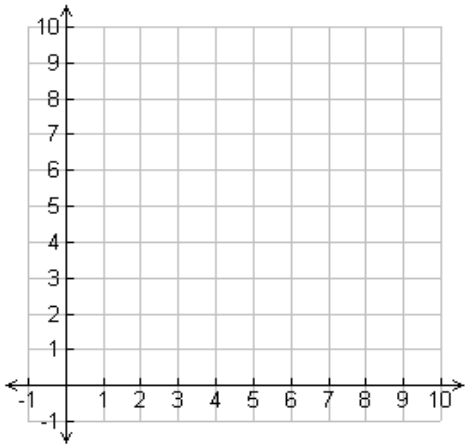
Explain your situation in words.

_____

_____

Table

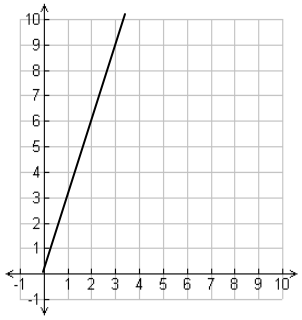
Graph (make sure to label axes and title)



Unit Rate/Constant: _____ Equation: _____

For Questions 1-3, determine whether each table or graph forms a proportional relationship. If they do, identify the constant of proportionality.

1)



Proportional? Yes or No Explain

Constant of Proportionality _____

2)

Hours	Miles
1	20
2	60
3	80
4	110
5	120

Proportional? Yes or No Explain

Constant of Proportionality _____

3)

x	2	4	6	8	10
y	1.5	3	4.5	6	7.5

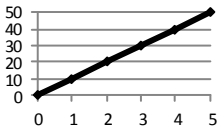
Proportional? Yes or No Explain

Constant of Proportionality _____

4) Which of the following has a constant of proportionality of 5?

a)

Item 1	Item 2
2	10
3	15
4	20
5	25



b)

c) $y = \frac{1}{5}x$

d) $y = x + 5$

5) The table shows the distance Katie drove on one day of her vacation.
Is the relationship between the distance and the time a proportional relationship? Yes or No Why or why not?

Time (h)	1	2	3	4	5
Distance (mi)	65	120	195	220	300

Do you think Katie drove at a constant speed for the entire trip? Yes or No Why or why not?

6)

Is this situation proportional? Yes or No

Number of Candy Bars	3	6	15
Cost ($)	6	12	30

If so, what is the unit rate?

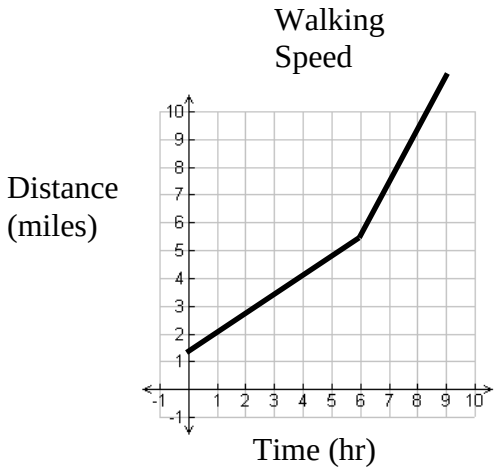
Write an equation to represent this relationship.

_____

How much will it cost for 45 candy bars?

---

7)



Part A: Is it proportional? Yes or No
Explain_____
_____

Part B: What is the constant of proportionality between hour 6 and hour 9?

Part C What is the average rate of speed throughout the whole trip?

Tell whether the relationship is a proportional relationship. If so, give the constant of proportionality.

8)

Number of Minutes	3	4	5	6	7
Number of Seconds	180	240	300	360	420

Proportional: yes or no
If so, what is the constant of proportionality
_____

---

9)

Time (h)	1	2	3	4	5
Biking Distance(mi)	12	26	36	44	50

Proportional: yes or no
Justify your answer
_____

---

10) Dominick reads 9 pages in 27 minutes, 12 pages in 36 minutes, 15 pages in 45 minutes, and 50 pages in 150 minutes. Does this situation have proportionality (direct relationship)? yes or no Justify answer.

---

11) A scuba diver descends at a constant rate of 8 feet per minute. Write an equation for this situation.

Complete the table, graph, identify the constant of proportionality, and write the equation.

12a)

Time (min)	1	2	3		10
Water Used (gal)	5			35	

Constant of Proportionality _____ Equation _____

12b)

x	*y*
2	6
3	9
4	12
8	

Constant of Proportionality _____

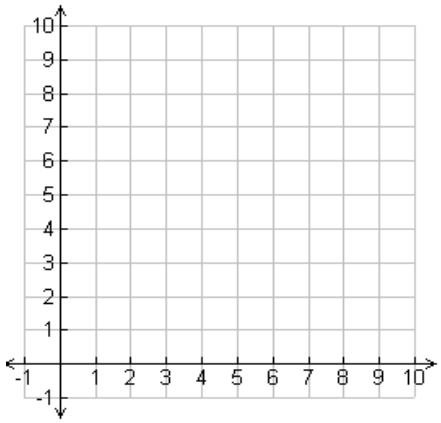
Equation _____

---

13) Plot the following points on a coordinate grid.
(2,3), (4,6), (6,9)

Find the constant of proportionality _____

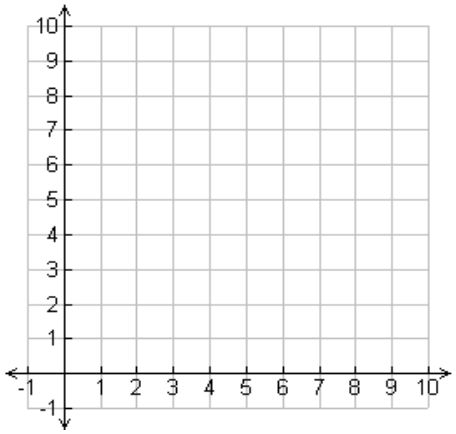
What is the equation?_____



14) Plot the following points on a coordinate grid.
(4,8), (2,4), (0,0)

Find the constant of proportionality ____

What is the equation?_____



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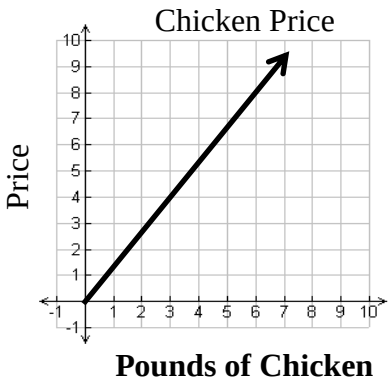
15)



a) Is the graph proportional?

b) What is the constant of proportionality?

c) What is the unit price?

d) What is the equation of the line?

16) The function table below shows the relationship between the side lengths of a regular octagon and its perimeter.

Side Lengths, s (inches)	Perimeter, P (inches)
1	8
2	16
3	24
4	32
9	?

a) What is the constant of proportionality? _____
b) Write an equation to represent the situation._____
c) If a regular octagon has side lengths of 9 inches, what is the perimeter?

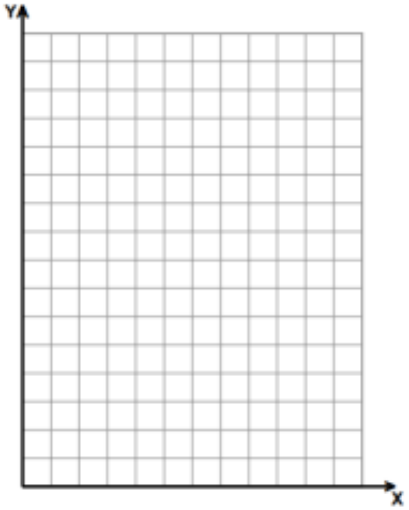
---

17) A movie theater charges $4 per movie ticket. How much would it cost for five people? Make a graph to represent the situation. (Let *x* represent the number of tickets. Let *y* represent the cost, in $'s)

Write an equation to represent the situation. _____
Complete the function table.

Number of tickets (x)	0	1	2	3	4
Cost in Dollars (y)					

Create a graph to show the values in the table. (Be sure to label)



The graph passes through the point (1,____). So, _____ is the constant of proportionality, or the unit rate.
It would cost _____ for six people.

Mixed Review (No Calculator)

18) $-2 - 5 - (-4)$

19) $-\frac{3}{8} \bullet \frac{4}{5}$

20) Evaluate $(-1)^5$

21) Write $\frac{3}{8}$ as a decimal.

22) Is $\frac{1}{9}$ repeating or terminating decimal?

23) Evaluate $1\frac{1}{2} \div 2\frac{5}{6}$

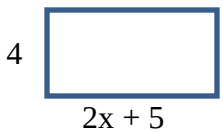
24) Factor: $2x - 10$

25) Factor: $12x + 20$

26) Simplify: $-3(5x + 1)$

27) Simplify: $2(3x - 2)$

28) Find the Perimeter



29) Find the Area