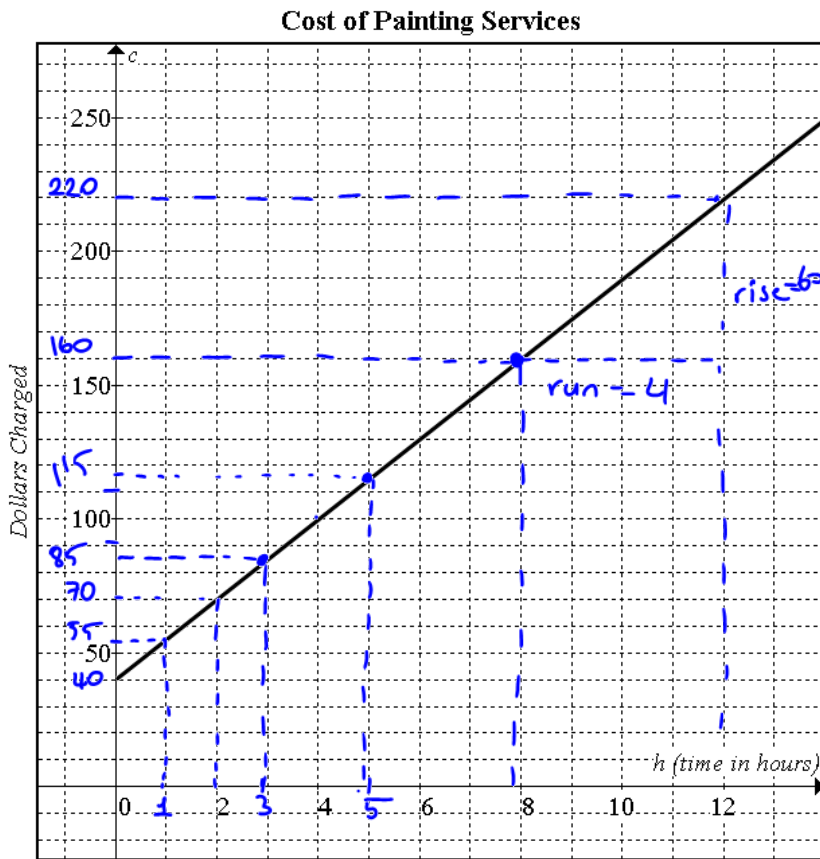# Applications of Linear Equations

Date:

1. a) A painter charges $115 for 5 hours' work, $85 for 3 hours' work and $160 for 8 hours' work. Graph these 3 points on the grid below, *then draw a line through these points and extend it to the edge of the grid.*

Cost of Painting Services

Time (h)	Charge ($)
0	40
1	55
2	70
3	85
4	100
5	115
6	130
7	145
8	160
9	175
10	190
11	205
12	220

b) Use the above graph to complete the table of values at right above.

c) Does the table entry for 12 h use *extrapolation* or *interpolation*? _____

d) Does the table entry for 6 h use *extrapolation* or *interpolation*? _____

e) Is *c* the (*dependent*) or *independent* variable?   dependent

f) Draw a rise/run triangle on the graph and calculate the slope: $m = \frac{60}{4} = \$15/h$

g) The slope describes the rate of change of ___Cost___ per ___hour___.

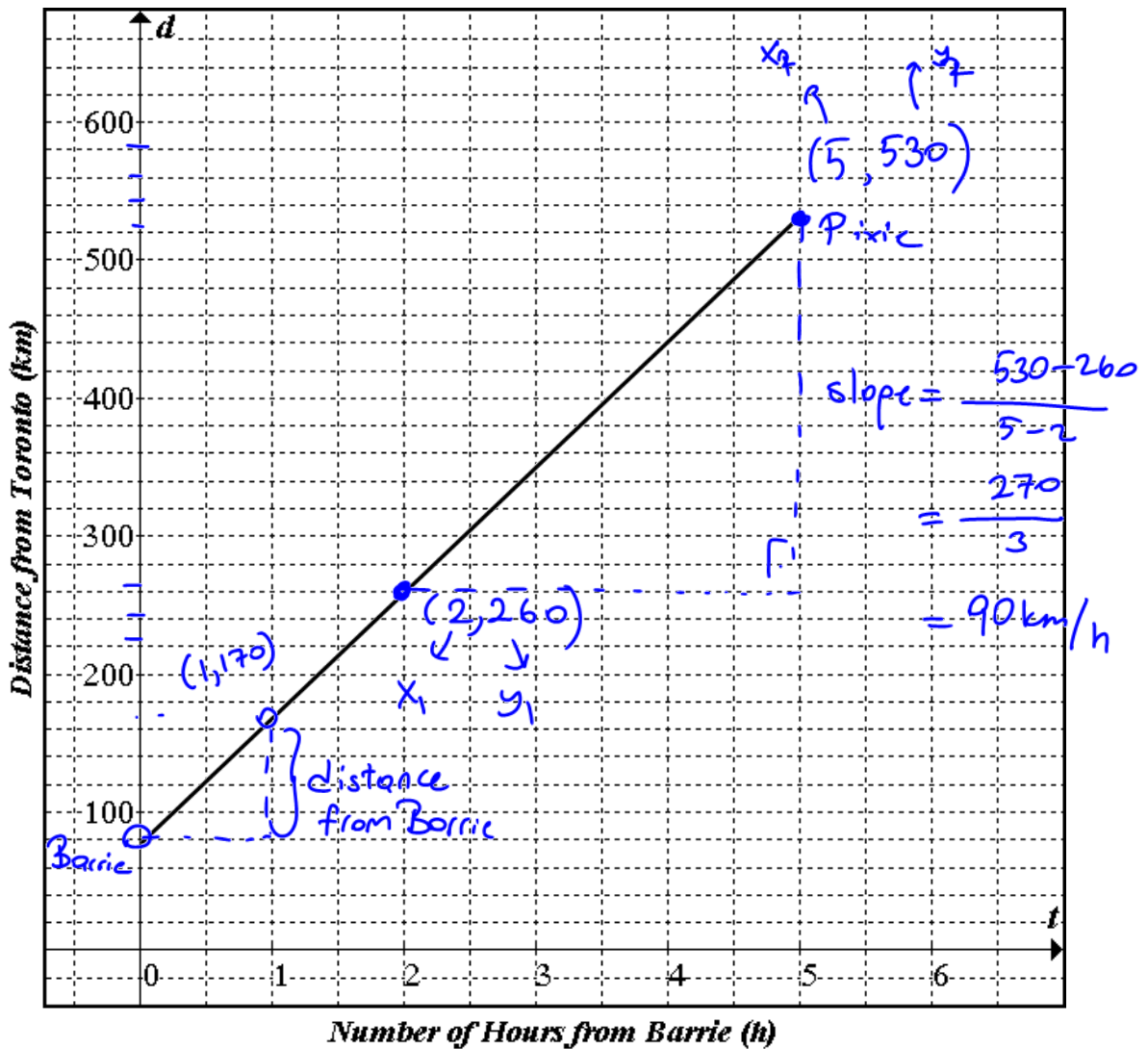h) How does the *vertical*-intercept of the line describe the painter's fees?
   It tells us the initial fee of 40 just to come to site

i) State the equation of the line using *c* and *h* as the variables. $C = 15h + 40$

$$y = mx + b$$
$$c = 15h + 40$$

2. Pixie is driving north from Toronto on Highway 400. She passes through the town of Barrie without stopping. Two hours after passing Barrie, she is 260 km from Toronto. Five hours after passing Barrie, she is 530 km from Toronto. Assuming that she is driving at a constant speed, complete the graph of her distance (d) from Toronto at time t hours after passing Barrie (assume $t = 0$ at Barrie).

Graph annotations:
- $(5, 530)$ Pixie
- x_2 y_2
- $\text{slope} = \dfrac{530 - 260}{5 - 2} = \dfrac{270}{3} = 90 \text{ km/h}$
- $(2, 260)$ x_1 y_1
- $(1, 170)$
- distance from Barrie
- Barrie

X-axis: **Number of Hours from Barrie (h)**
Y-axis: **Distance from Toronto (km)**

a) Determine the slope of the line above. $m =$ $\underline{90}$

b) State the vertical intercept of the line. $\underline{(0, 80)}$

c) Determine the equation of the line using **d** and **t** as variables. $\underline{d = 90t + 80}$

d) What does the *vertical*-intercept of the graph tell you about the trip? $\underline{\text{The distance of Barrie from TO}}$

$d = 90(1) + 80$
$d = 170$

e) How far from Barrie is Pixie when $t = 1$? $\underline{170 - 80 = 90 \text{km}}$

f) What does the slope of the graph tell you about the trip? $\underline{\text{speed}}$

g) The slope describes the rate of change of $\underline{\text{distance}}$ per $\underline{\text{hour}}$.

3. The cost of a pizza is based on the number of toppings chosen. If the equation **c = 1.25n + 9.00** gives the cost (c) for the number of toppings (n), complete the table of values below:

Number of toppings (n)	0	1	2	3	4	5	6
Cost of Pizza (c)	9.00	10.25	11.50	12.75	13.00	14.25	15.50

a) How much more does a 3 topping pizza cost than one with 2 toppings? _12.75 − 11.50 = $1.25_

b) How much more does a 6 topping pizza cost than one with 5 toppings? _15.50−14.25 = $1.25_

c) If this equation were graphed, what would be its slope? _m= 1.25_

d) The slope represents the rate of change of _price_ per _toppings_

e) If this equation were graphed, what would be its *vertical*-intercept? _9.00_

f) What is the meaning of the *vertical*-intercept in this problem? _price of the pizza without toppings_

4. The cost of riding in a taxi is given by **t = 1.3k + 2.7** where **k** is the number of kilometres driven.

Number of kilometres (k)	3	5	8	9	15
Total Cost (t) in dollars	3.9+2.7 = 6.6	1.3(5)+2.7 = 6.5+2.7 = 9.2	1.3(8)+2.7 = 10.4+2.7 = 13.1	1.3(9)+2.7 = 11.7+2.7 = 14.4	1.3(15)+2.7 = 22.2

a) How much more does it cost to ride 8 km than 3 km? _13.1−9.2 = 3.9_

b) How much more does it cost to ride 9 km than 8 km? _14.4−13.1 = 1.3_

c) If this equation were graphed, what would be its slope? _1.3_

d) The slope represents the rate of change of _total cost_ per _kilometres_

e) If this equation were graphed, what would be its *vertical*-intercept? _2.7_

f) What is the meaning of the *vertical*-intercept in this problem? _to flag the taxi you pay $2.7 as a flat rate._

5. A new car gradually depreciates (loses value) after it is purchased. In other words, the older the car gets, the less its value. Jeff buys a new car and its value **y** years after it was purchased is given by:
v = –2300y + 20700 where **v** is the value of the car in dollars.

a) What is the value of Jeff's car 3 years after he purchases it? $-2300(3) + 20700 = \$13800$

b) What is the value of Jeff's car 1 year after he purchases it? $-2300(1) + 20700 = \$18400$

c) What is the value of Jeff's car when it was new? $-2300(0) + 20700 = \$20700$

d) After how many years will the car be of no value? $0 = -2300y + 20700 \Rightarrow \frac{2300y}{2300} = \frac{20700}{2300}$

$\boxed{y = 9 \text{ years}}$

e) At what rate is the car depreciating (losing value)? $\$2300$ per year

6. Write an equation that suits the following situations:

Situation	Variables	Equation
A printing job costs $200 plus $25 per set.	c , s	$C = 25s + 200$
Photofinishing costs $3 plus $4 per set of 12 pictures.	c , s	$C = 4s + 3$
The amount of fuel in a gas tank is 72 litres minus the amount used which is 0.09 litres per kilometre driven.	a , d	$a = 72 - 0.09d$
The cost of hiring a disc jockey for a dance is $50 plus $20 per hour.	c , h	$C = 20h + 50$

7. The rental fees for a hardwood floor sanding machine is given in the table:

$x_1 \quad y_1 \qquad x_2 \quad y_2$

$A(3, 88) \quad B(7, 156)$

Hours (h)	0	3	7	9
Cost (c) in $	37	88	156	190

A   B   C

a) Assuming that time in hours is the independent variable (horizontal axis), use the formula for slope to calculate the slope from 3 to 7 hours. $\frac{156-88}{7-3} = \frac{68}{4} = 17$

b) Calculate the slope from 3 to 9 hours.
$A(3, 88)$
$C(9, 190)$
$\frac{190-88}{9-3} = \frac{102}{6} = 17$

c) Give an equation for this linear relationship.
$\boxed{C = 17h + 37}$