

Similar to test Question

A company sells pencils.
Is the following a linear or non-linear relation? **Prove**

Can you connect the dots if you were to draw this on graph paper?

$$\frac{\Delta y}{\Delta x}$$

A company does Not
Sell half a pencil
So cannot connect
dots (Discrete)

# of Pencil	Cost (\$)
n	
6	10.00
8	11.00
15	14.50
20	17.00
30	22.00

$$\frac{\Delta y}{\Delta x} = \frac{1}{2} = 0.5$$

$$\frac{3.50}{7} = 0.5$$

$$\frac{2.50}{5} = 0.5$$

$$\frac{5}{10} = 0.5$$

Rates of
Change are
all 0.5 (Same)
So linear

$$D \quad \{x \mid - \leq x \leq -, x \in -\}$$

$$R \quad \{y \mid - \leq y \leq -, y \in -\}$$

3. Which tables of values represent linear relations? Explain your answers.

a)

Time (min)	Distance (m)
0	10
2	50
4	90
6	130

Linear

+2
+40
+10

b)

Time (s)	Speed (m/s)
0	10
1	20
2	40
3	80

Non Linear

+10
+20
+40



c)

Speed (m/s)	Time (s)
15	7.5
10	5
5	2.5
0	0

Linear

-5
-2.5
-2.5
-2.5

d)

Distance (m)	Speed (m/s)
4	2
16	4
1	1
9	3

Non Linear

+2
-3
+2

Rate = $\frac{15}{7.5} = 2$
 $\frac{10}{5} = 2$
 $\frac{5}{2.5} = 2$
 $\frac{0}{0} = 0$
 $\rightarrow R = \frac{3}{1.5} = 2$

4. Which sets of ordered pairs represent linear relations?

Explain your answers.

a) $\{(3, 11), (5, 9), (7, 7), (9, 5)\}$

Linear

b) $\{(-2, 3), (0, 1), (2, -3), (4, -7)\}$

Non Linear

c) $\{(1, 1), (1, 3), (2, 1), (2, 3)\}$

Non Linear

x	y
3	11
5	9
7	7
9	5

Handwritten annotations: $+2$ above the x-axis, -2 above the y-axis, and a slope calculation $R = \frac{-2}{2} = -1$.

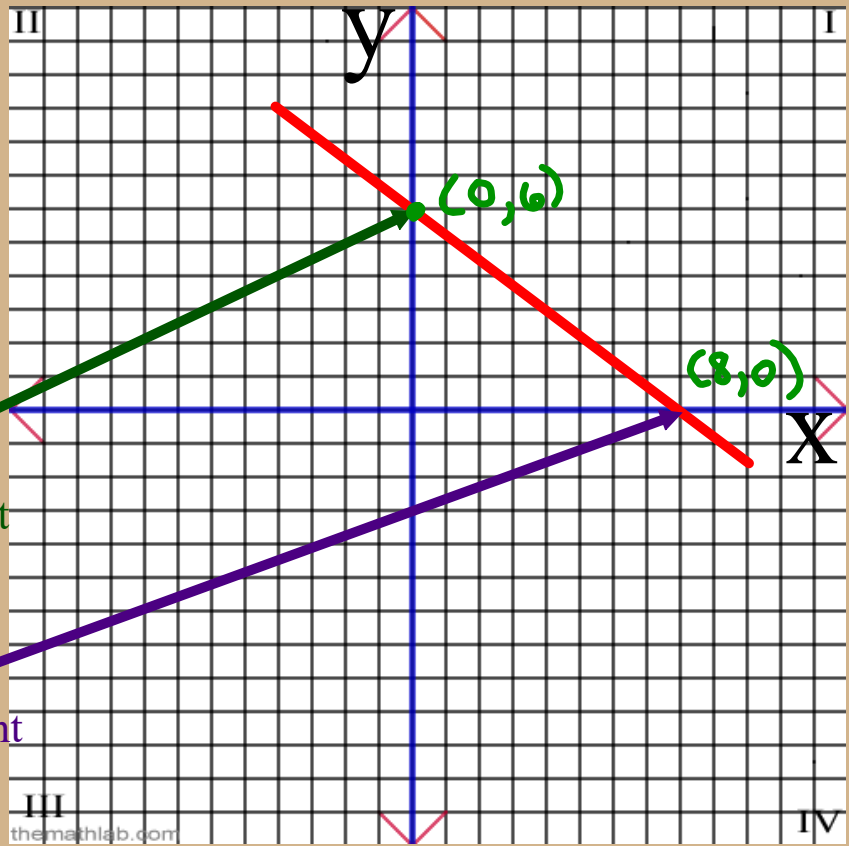
$$R = \frac{-2}{2} = -1$$

Section 5.7

Linear Relationships & Graph

1

Intercepts



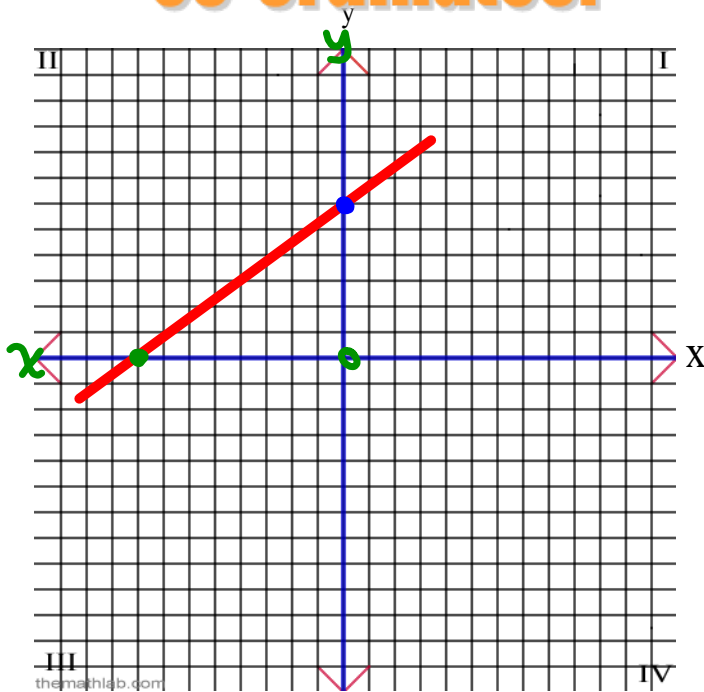
vertical

The "y-intercept is the point on the line that crosses the "y" axis.

horizontal

The "x-intercept is the point on the line that crosses the "x" axis.

2 How do you write the co-ordinates?



$$\text{x-intercept} = \underline{-8}$$

point
coordinates $(-8, 0)$

$Y = 0$ for the x-intercept.

$$\text{y-intercept} = \underline{6}$$

coordinates
 $(0, 6)$

$X = 0$ for the y-intercept.

2. Sketch a graph of the linear function $f(x) = 4x - 3$.



x -intercept

(let $y=0$)

$$0 = 4x - 3$$

$$3 = 4x$$

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

$$\boxed{\frac{3}{4} = x}$$

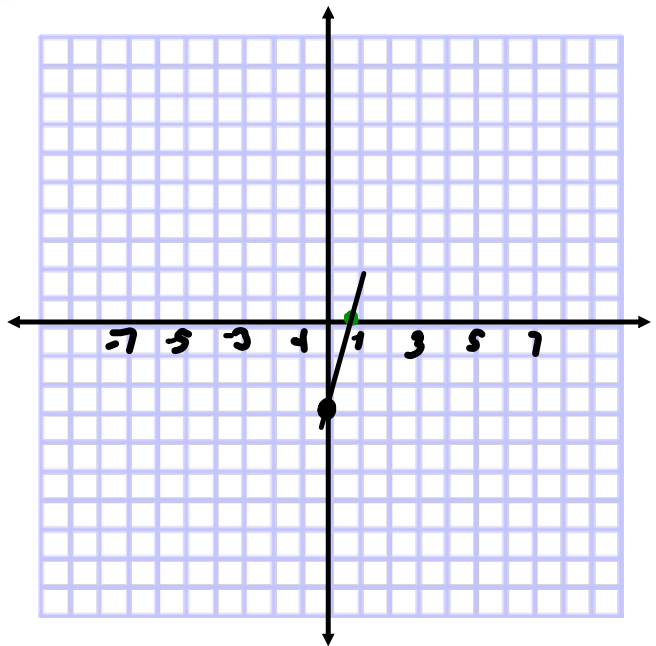
y -intercept (let $x=0$)

$$y = 4x - 3$$

$$4(0) - 3$$

$$0 - 3$$

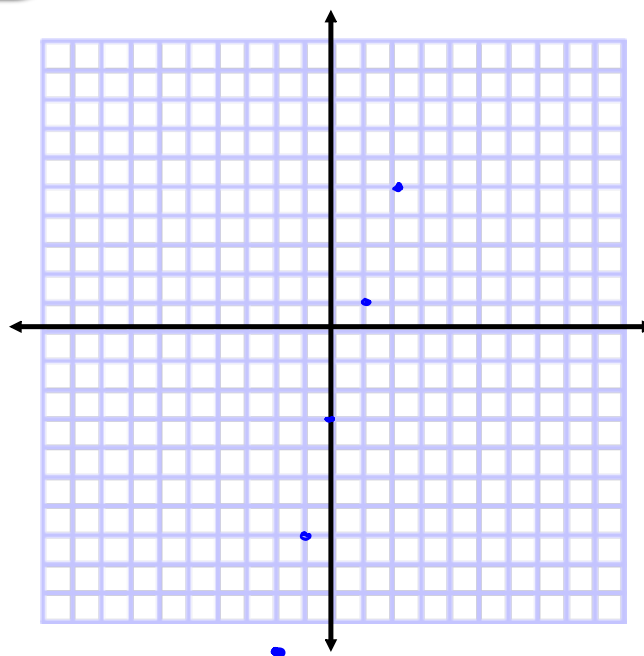
$$\boxed{y = -3}$$



2. Sketch a graph of the linear function $f(x) = 4x - 3$.



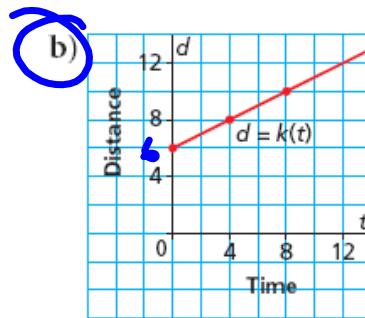
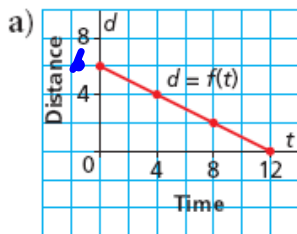
x	$f(x)$
-2	-11
-1	-7
0	-3
1	1
2	5



Example 3

Matching a Graph to a Given Rate of Change and Vertical Intercept

Which graph has a rate of change of $\frac{1}{2}$ and a vertical intercept of 6? Justify the answer.



$\frac{\Delta y}{\Delta x}$ rise \updownarrow
run \leftrightarrow

$\frac{+1}{+2}$ up
Right

SOLUTION

+ Rate / uphill from Left to Right
- Rate \ downhill



CHECK YOUR UNDERSTANDING

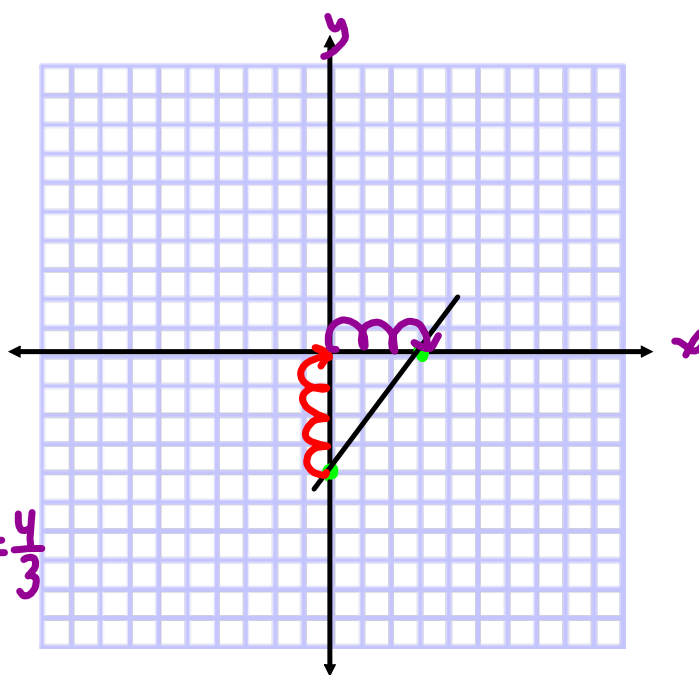
Graph the following:

y intercept = -4

x Intercept= 3

See graph

rate of Change = ? $\frac{\text{rise } +4}{\text{run } +3} = \frac{4}{3}$



$$y = mx + b$$

#

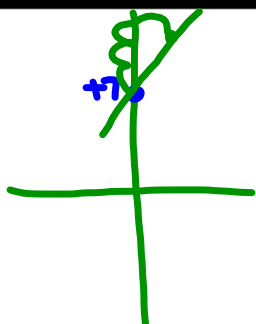
m = Rate of Change (Slope)
b = initial cost (vertical intercept or y-int.)

$$y = 3x + 7$$

rate y intercept

Slope

$$m = \frac{3 \text{ rise}}{1 \text{ run}}$$



Find the Slope and Y-intercept

$$y = m x + b$$

rate y-int

1) $y = 5x + 10$

$m = 5$ $b = 10$



$$y = mx + b$$

2) $P = -2t - 3$

$m = -2$ $b = -3$

3) $R = \frac{-5}{2}g + 7$

$m = \frac{-5}{2}$ $b = +7$

4) $y = 8 + \frac{1}{2}x$

$m = \frac{1}{2}$ $b = 8$

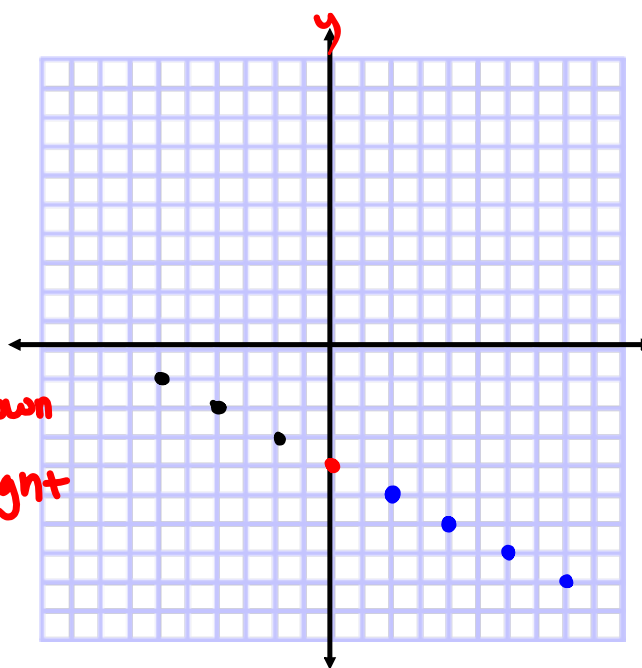
Graph the following:

y intercept = -4

Slope = -1/2

$$m = \frac{-1}{2} \begin{array}{l} \text{rise down} \\ \text{run right} \end{array}$$

$$-\frac{1}{2} = \frac{1}{-2} = -\frac{1}{2}$$



Homework

Page: 308-310

Questions: ~~4a,b~~, 7a,b, 14

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Question 4b(i, ii, **iii**), 8 *Matching*

5.6 Properties of Linear Relations

Exercises

A

5

B

6 7 8 9 10 11 12 13

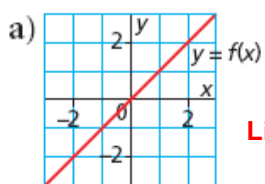
14 15 16 17

C

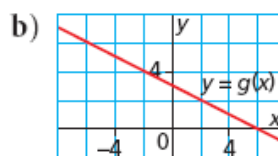
18 19 20 21 22

Reflect

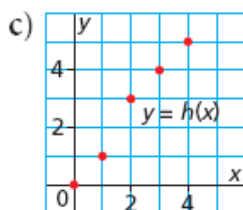
5. Which graphs represent linear relations? How do you know?



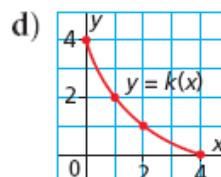
Linear



Linear



Non Linear



Non Linear

6. a) Create a table of values when necessary, then graph each relation.

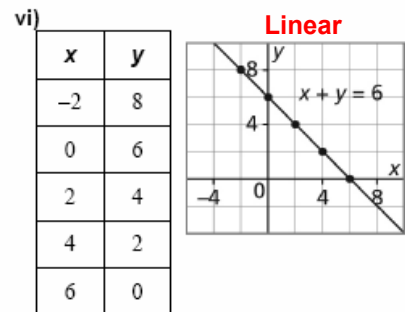
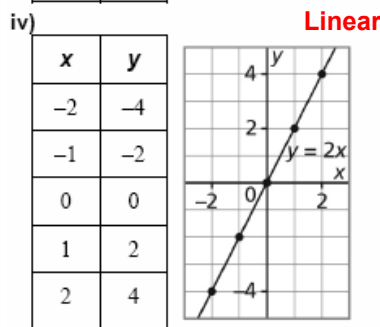
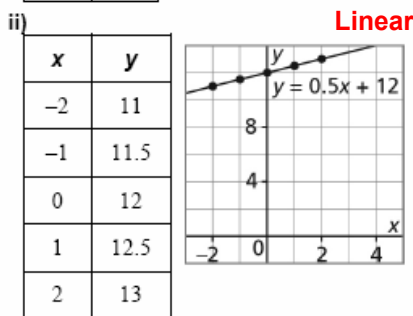
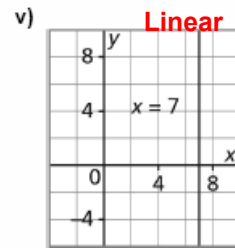
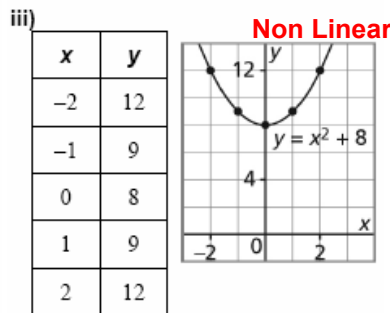
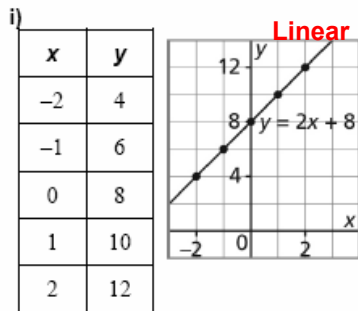
i) $y = 2x + 8$ ii) $y = 0.5x + 12$

iii) $y = x^2 + 8$ iv) $y = 2x$

v) $x = 7$ vi) $x + y = 6$

b) Which equations in part a represent linear relations? How do you know?

a) Tables of values may vary. For example:



b) The relations in part a, i, ii, iv, v, and vi are straight lines, so they are linear relations.

7. For each relation below:

- i) Identify the dependent and independent variables.
- ii) Use the table of values to determine whether the relation is linear.
- iii) If the relation is linear, determine its rate of change.

a) The distance required for a car to come to a complete stop after its brakes are applied is the *braking distance*. The braking distance, d metres, is related to the speed of the car, s kilometres per hour, when the brakes are first applied.

b) The altitude of a plane, a metres, is related to the time, t minutes, that has elapsed since it started its descent.

Independent **Dependent**

	s (km/h)	d (m)
10	50	13
10	60	20
10	70	27
10	80	35

Non Linear

Independent **Dependent**

	t (min)	a (m)
	0	12 000
2	2	11 600
2	4	11 200
2	6	10 800
2	8	10 400

5.6 Properties of Linear Relations

8. In a hot-air balloon, a chart shows how the distance to the horizon, d kilometres, is related to the height of the balloon, h metres.
- Graph these data.
 - Is the relation linear? What strategy did you use?

h (m)	d (km)
5	8
10	11
30	20
50	25
100	36



9. Earth rotates through approximately 360° every 24 h. The set of ordered pairs below describes the rotation. The first coordinate is the time in hours, and the second coordinate is the approximate angle of rotation in degrees. Describe two strategies you could use to determine if this relation is linear.

$\{(0, 0), (6, 90), (12, 180), (18, 270), (24, 360)\}$



10. Sophie and 4 of her friends plan a trip to the Edmonton Chante for one night. The hotel room is \$95 for the first 2 people, plus \$10 for each additional person in the room. The total cost is related to the number of people. Is the relation linear? How do you know?

$$C = 10p + 95$$

Number of additional person (p)	Total Cost (C)
0	95
1	105
2	115

Linear

11. A skydiver jumps from an altitude of 3600 m. For the first 12 s, her height in metres above the ground is described by this set of ordered pairs: $\{(0, 3600), (4, 3526), (8, 3353.5), (12, 3147.5)\}$. For the next 21 s, her height above the ground is described by this set of ordered pairs: $\{(15, 2988.5), (21, 2670.5), (27, 2352.5), (33, 2034.5)\}$. Determine whether either set of ordered pairs represents a linear relation. Explain.



12. The cost, C dollars, to rent a hall for a banquet is given by the equation $C = 550 + 15n$, where n represents the number of people attending the banquet.

a) Explain why the equation represents a linear relation.

The equation is a linear equation because the cost of the hall is \$ 550 just to rent the hall and you must add \$15 for each person that attends the banquet

Dependent Variable: Is the cost of the hall since you need to know the number of people who attend before you can pay for the hall

Independent: Number of people

b) State the rate of change. What does it represent?

Rate of change= $\frac{\text{cost}}{\text{number of people}}$

- 13.** A safety flare is shot upward from the top of a cliff 200 m above sea level. An equation for the height of the flare, d metres, above sea level t seconds after the flare is fired, is given by the equation $d = -4.9t^2 + 153.2t + 200$. Describe two strategies you could use to determine whether this relation is linear.

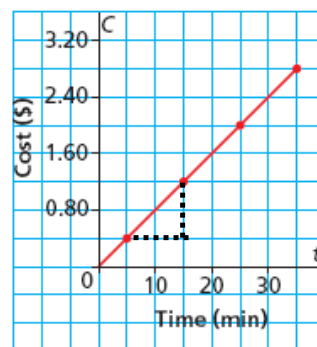


14. This graph represents Jerome's long distance phone call to his pen pal in Nunavut. Jerome is charged a constant rate.
- a) Identify the dependent and independent variables.

Independent Variable: Time (min)

Dependent Variable: Cost (\$)

The Cost of Jerome's Phone Call



- b) Determine the rate of change, then describe what it represents.

$$\text{Rate of change} = \frac{\text{difference of cost}}{\text{difference of time}} = \frac{\$ 0.80}{10 \text{ min}} = \$0.08 / \text{min}$$

15. Kashala takes a cross-country trip from her home in Lethbridge through the United States. In Illinois, she drives on a toll highway. This graph represents the cost of Kashala's drive on the toll highway. She is charged a constant amount at each toll booth and she starts with US\$10 in change. Determine the rate of change, then describe what it represents.

$$\text{Rate of Change} = \frac{\text{Change in Money}}{\text{Change in Tolls booth}}$$

$$= \frac{8.20 - 7.60}{2 - 3}$$

$$= \frac{\$ 0.80}{-1}$$

$$= - \$0.8/\text{booth}$$

Kashala's Drive on the Toll Highway

