Similar to test Question

A company sells pencils.

Is the following a linear or non-linear relation? Prove

Linear → Rate of change is
$0.5/pencil for each
interval

Can you connect the dots if you were to
draw this on graph paper? No cannot
connect since
you don't
buy half a pencil

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

$= \frac{1}{2}$

$= 0.5$

$= \frac{3.50}{7}$

$= 0.5$

$\frac{2.5}{5}$

$= 0.5$

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

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

2
7
5
10

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

a)

Linear +2

$R = \frac{40}{2}$

$= 20 m/min$

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

+40

b)

+1

+1

Non Linear

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

+10

+20

c)

Linear

−5

$R = \frac{-25}{5}$

$= -0.55 m/s$

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

−2.5

−2.5

−2.5

d)

+12

−15

Non Linear

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

+2

−3

+2

Rate $= \frac{2}{12}$

$= 0.16$

$R = \frac{3}{-15}$

$= -0.2$

5.6 Properties of Linear Relations

4. Which sets of ordered pairs represent linear relations? Explain your answers.

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

Linear

$$\begin{array}{c|c} X & y \\ \hline 3 & 11 \\ 5 & 9 \\ 7 & 7 \\ 9 & 5 \end{array}$$

$+2$ -2

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

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

$+2$ $+2$ $+2$

Non Linear

-2 -4 -4

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

0 $+1$ 0

Non Linear

$+2$ -2 $+2$

5.6 Properties of Linear Relations

6) $y = x^2 + 8$

Non linear

v) $x = 7$

Linear

7a)
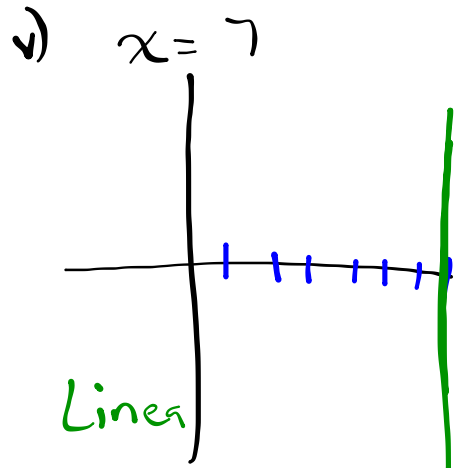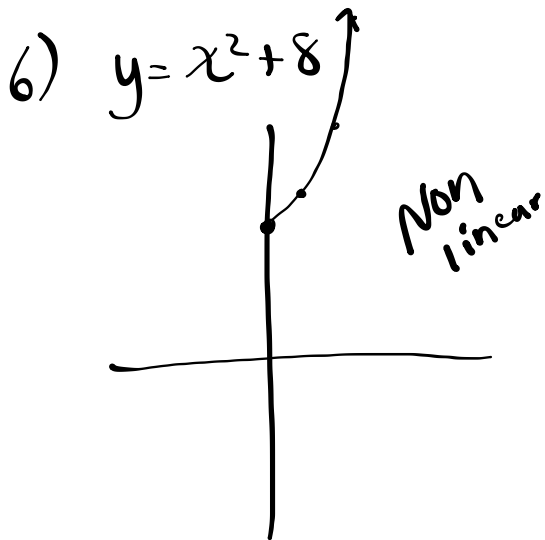
50	13
60	20
70	27
80	35

Non Linear

Section 5.7

Linear Relationships

&

Graph

1

Intercepts

II   y   I

(0,6)
(0,y)

$y=0$

(8,0)
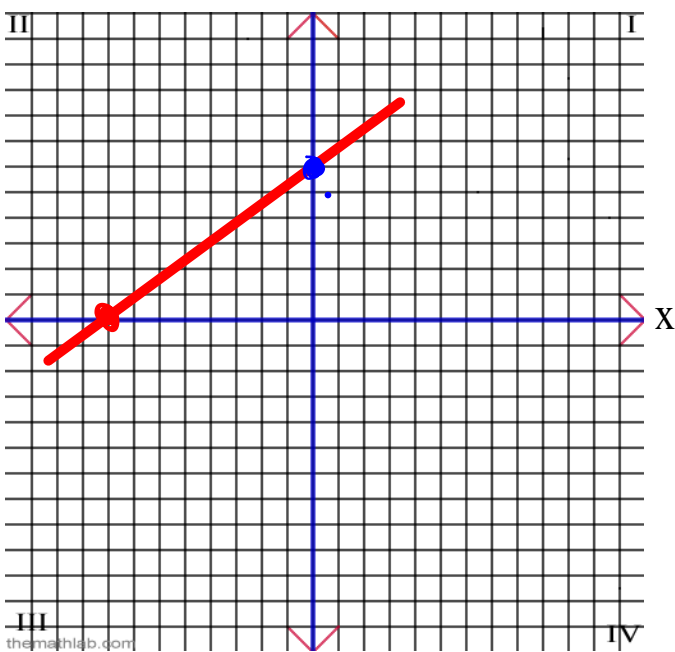
X

The "y-intercept is the point on the line that crosses the "y" axis. **X will always be zero**

The "x-intercept is the point on the line that crosses the "x" axis. **y will always equal zero**

III   IV

themathlab.com
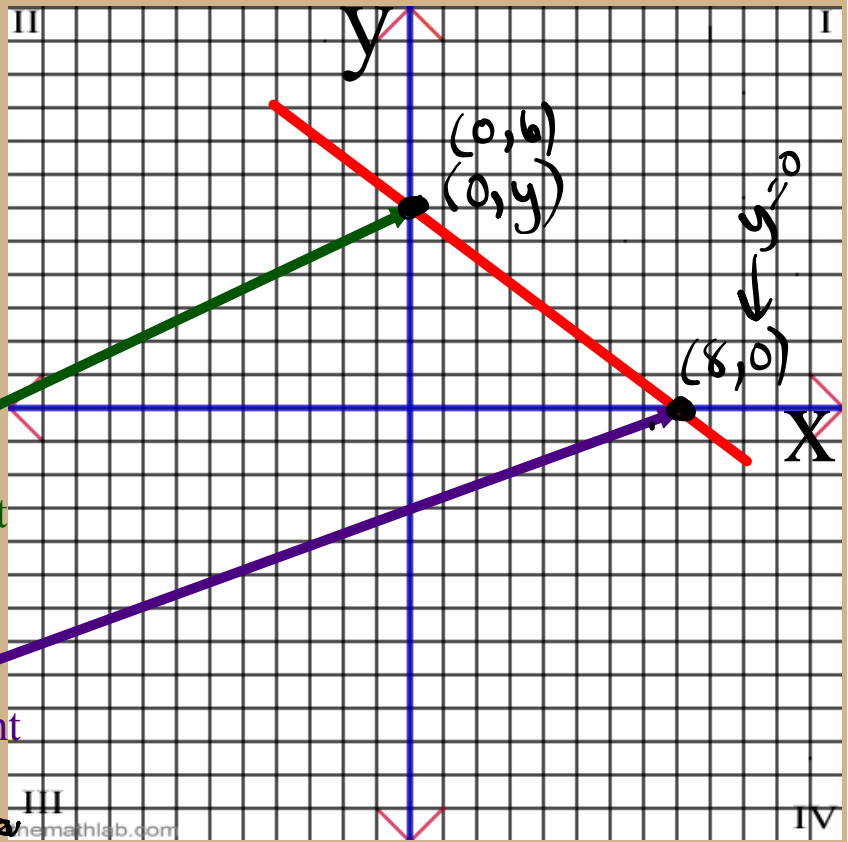
2

How do you write the co-ordinates?

x-intercept = -8

$(-8, 0)$

Y = 0 for the x-intercept.

y-intercept = 6

x, y
$(0, 6)$

X = 0 for the y-intercept.

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

$y = 4x - 3$

lets find x intercept

let $y = 0$

$f(x) = 4x - 3$

$y = 4x - 3$

$0 = 4x - 3$

$0^{+3} = 4x - 3 + 3$

$3 = 4x$

$\overline{4} \quad \overline{4}$

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

$0.75 = x$

$y = 4x - 3$

$y = 4(0) - 3$

$\underset{0 \cdot -3}{}$

$y = -3$

y intercept
let $x = 0$
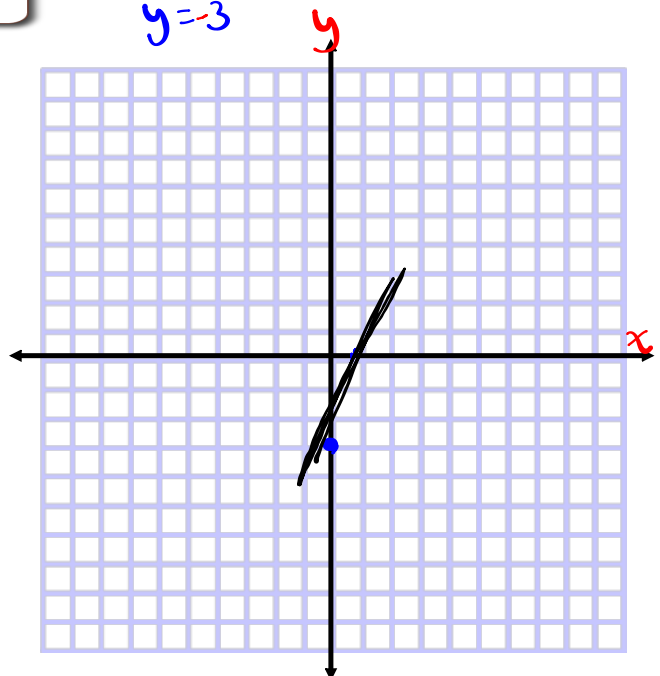
2. Sketch a graph of the linear function $f(x) = 4x - 3$.

x	$f(x)$
-2	-11
-1	-7
0	-3
1	1
2	5
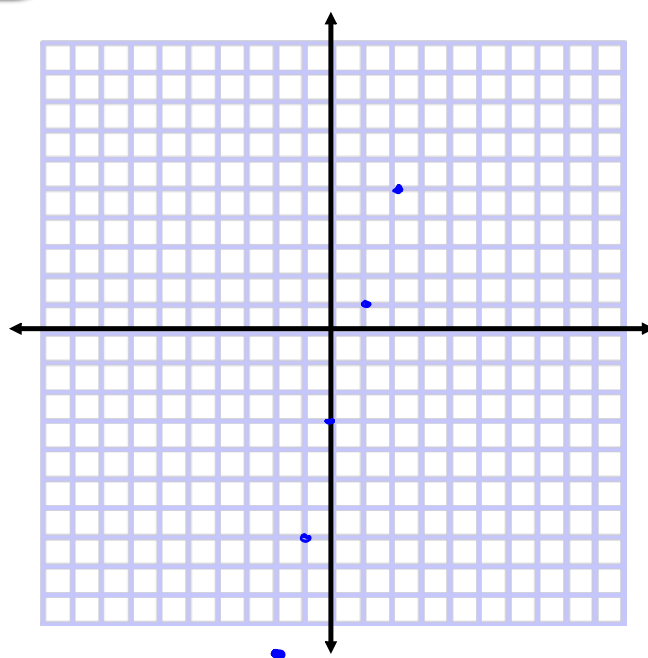
| **Example 3** | **Matching a Graph to a Given Rate of Change and Vertical Intercept** |

y-intercept (y-axis)

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

a)

Distance

8 d
6
4 $d = f(t)$
2

0   2   4   6   8   10   12 t

Time

b)

Distance

12 d

8
$d = k(t)$
4

0   4   8   12 t

Time

rise

$Rate = \dfrac{+4}{+8 \text{ run}} = \dfrac{1}{2}$

B
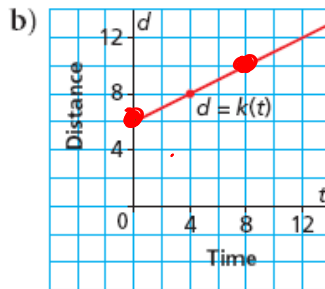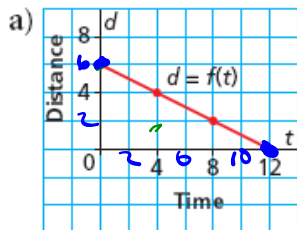
✓ **SOLUTION**

$Rate = \dfrac{-6}{12} = \dfrac{-1}{2} = \dfrac{\Delta y}{\Delta t} \dfrac{rise}{run}$

5.7 Interpreting Graphs of Linear Functions
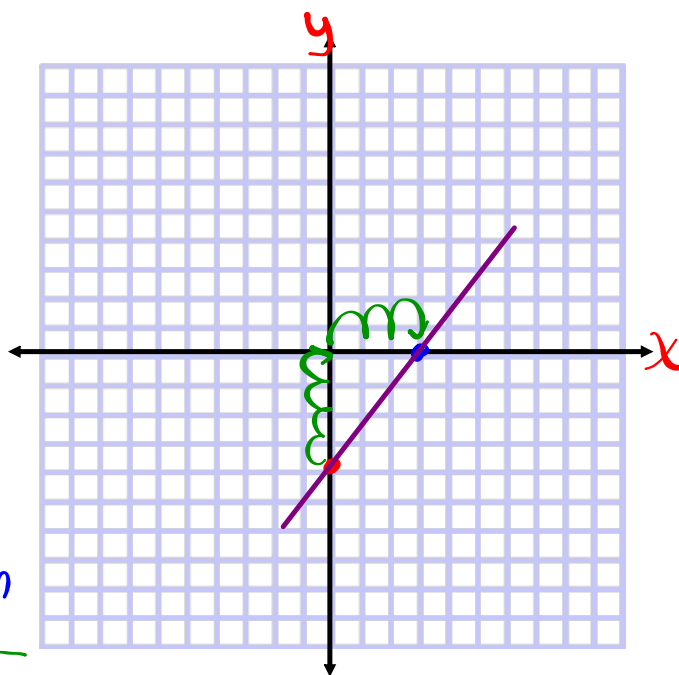
Graph the following:

y intercept = -4

x Intercept= 3

rate of Change= ? $\dfrac{\Delta y}{\Delta x}$ $\dfrac{rise}{run}$

$$= \dfrac{+4}{+3}$$

$$= 1.\overline{3}$$

$$y = mx + b$$

# #

m = Rate of Change (Slope)

b = initial cost (vertical intercept or y-int.)

Find the Slope and Y-intercept

$y = mx + b$

slope   y intercept

1) $y = 5x + 10$

m   b

$m = 5$

$b = 10$ ← y intercept
x has to be zero

$(0, 10)$
(x, y)

$y = mx + b$

X intercept
let y = 0

$y = 5x + 10$
$0 = 5x + 10$
$0 \overset{-10}{=} 5x + 10 - 10$
$\dfrac{-10}{5} = \dfrac{5x}{5}$

$\boxed{-2 = x}$

(x, y)
$(-2, 0)$

2) $P = -2t - 3$

$m = -2$
$b = -3 \rightarrow (0, -3)$

let y = 0
let p = 0

$0 = -2t - 3$
$0 +3 = -2t - 3 +3$
$\dfrac{3}{-2} = \dfrac{-2t}{-2}$
$\dfrac{-3}{2} = t$
$\boxed{-1.5 = t}$

x, y
t, P
$(-1.5, 0)$

$y = mx + b$

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

$m = -\dfrac{5}{2}$
$b = +7 \rightarrow (0, 7)$

$0 \overset{-7}{=} \dfrac{-5}{2} g + 7$
$2(-7) = \dfrac{-5}{2} g$
$\dfrac{-14}{-5} = \dfrac{-5 g}{-5}$
$\boxed{2.8 = g}$

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

$y = 2.5x + 7$
$0 = -2.5x + 7$
$\dfrac{-7}{-2.5} = \dfrac{-2.5x}{-2.5}$
$\boxed{2.8 = x}$

Graph the following:
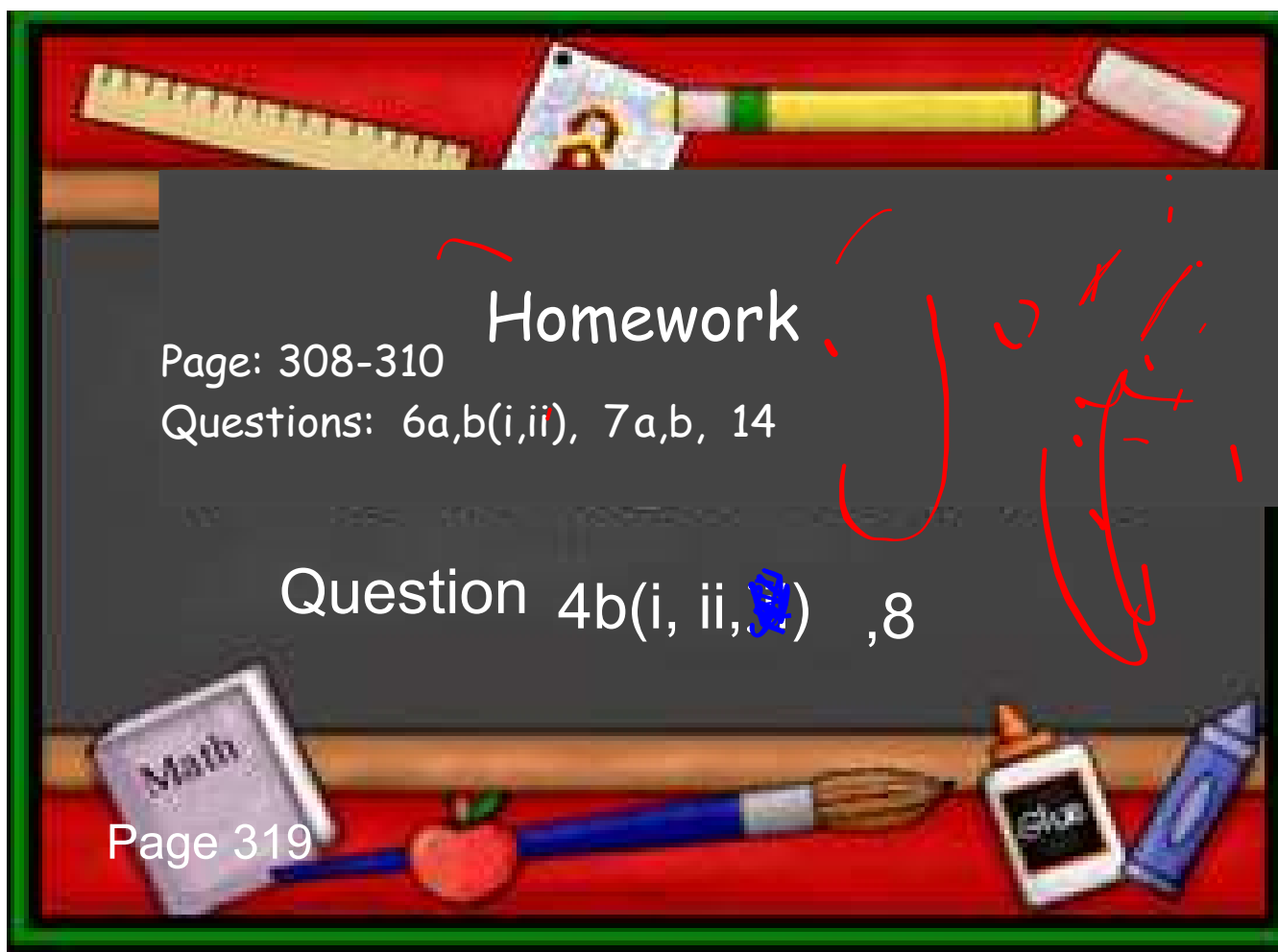
point

y intercept = -4

Slope = -1/2

$$= \frac{-1}{+2} \quad \frac{rise}{run} \quad \frac{Down}{Right}$$

+ Right or up

- down or left   OR

$$\frac{+1}{-2}$$
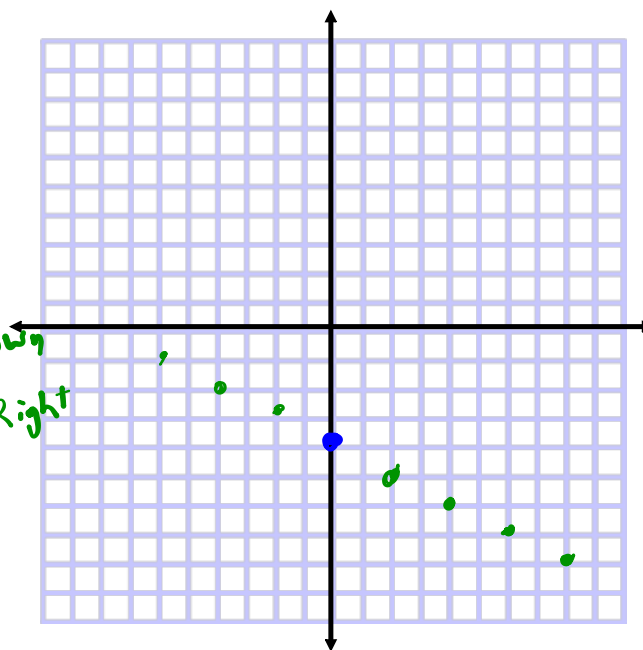
Homework

Page: 308-310
Questions: 6a,b(i,ii), 7a,b, 14

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

Page 319

5.6 Properties of Linear Relations

Exercises

A

5

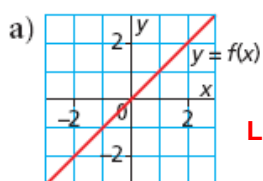**B**

6 7 8 9 10 11 12 13

14 15 16 17

C

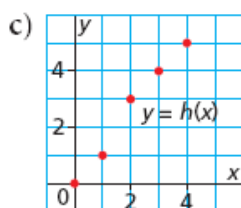18 19 20 21 22

Reflect

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

a)

$y = f(x)$

Linear

b)

$y = g(x)$

Linear

c)

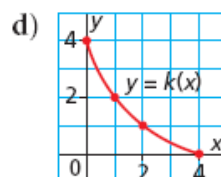$y = h(x)$

Non Linear

d)

$y = k(x)$

Non Linear

5.6 Properties of Linear Relations
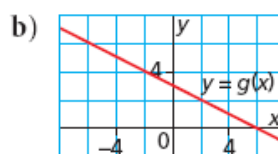
6. a) Create a table of values when necessary, then graph each relation.

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:

i) Linear

x	y
-2	4
-1	6
0	8
1	10
2	12

$y = 2x + 8$

ii) Linear

x	y
-2	11
-1	11.5
0	12
1	12.5
2	13

$y = 0.5x + 12$

iii) Non Linear

x	y
-2	12
-1	9
0	8
1	9
2	12

$y = x^2 + 8$

iv) Linear

x	y
-2	-4
-1	-2
0	0
1	2
2	4

$y = 2x$

v) Linear

$x = 7$

vi) Linear

x	y
-2	8
0	6
2	4
4	2
6	0

$x + y = 6$
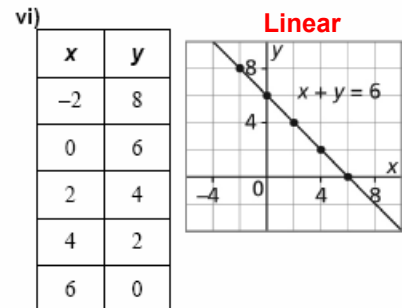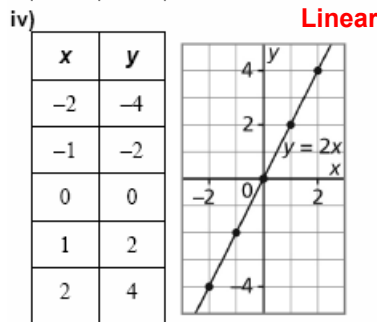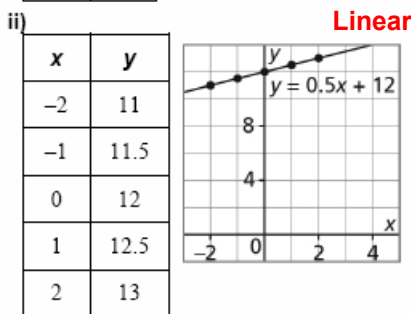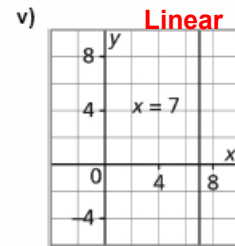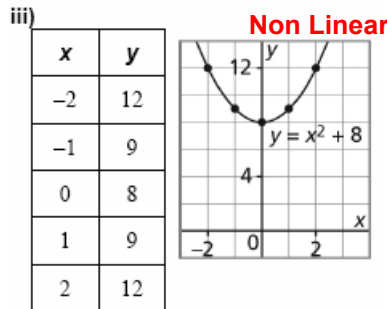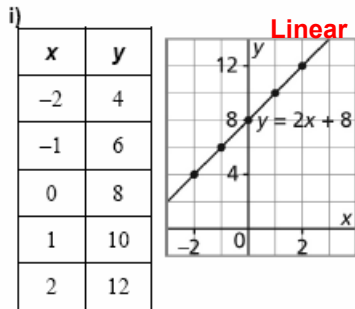
b) The relations in part a, i, ii, iv, v, and vi are straight lines, so they are linear relations.

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)
50	13
60	20
70	27
80	35

10 → 7
10 → 7
10 → 8

Non Linear

Independent　**Dependent**

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

2 → -400
2 → -400
2 → -400
2 → -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.

a) Graph these data.

b) Is the relation linear? What strategy did you use?

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

5.6 Properties of Linear Relations

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.

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

5.6 Properties of Linear Relations

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 = 10 p + 95

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

Linear

5.6 Properties of Linear Relations

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.

5.6 Properties of Linear Relations

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= $\dfrac{\text{cost}}{\text{number of people}}$

5.6 Properties of Linear Relations

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.
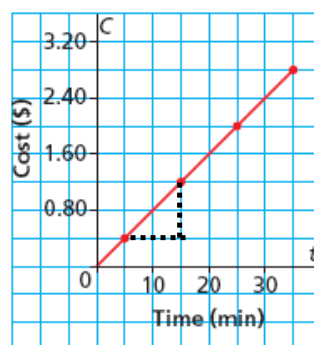
5.6 Properties of Linear Relations

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.

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

5.6 Properties of Linear Relations

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.

Kashala's Drive on the Toll Highway

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

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

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

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

5.6 Properties of Linear Relations