Solutions

Page 124 #s 2, 3, 4, 5, 7, 10, 14cd, 17

2. A full jar of candies contains 60 candies. Each day, 4 candies are removed from the jar.

a) Complete a table of values showing the number of candies in the jar after 0, 1, 2, 3, 4, 5 and 6 days.

b) Sketch a graph to show the number of candies in the jar each day from the time it is full to the time it is empty.

c) Identify the initial value and rate of change for the number of candies in the jar.

$= 60$

$= \frac{-60}{15}$

$= -4$ candies/day

d) Create an equation to model the number of candies in the jar, n, after t days.

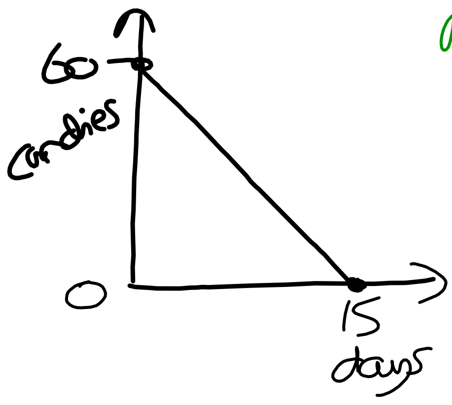
$n = 60 - 4t$

e) For what values of t does your equation apply?

For $t = 0$ up to and including $t = 15$

$\{0 \le t \le 15\}$

Day	# of candies
0	60
1	56
2	52
3	48
4	44
5	40



3. A linear relationship between volume and time is described by the given start value and rate. Determine an equation to model the volume (V) at a given time (t).

a) **Start:** 8 L
Rate: 3 L/min

b) **Start:** 540 mL
Rate: –20 mL/s

c) **Start:** 0 cm^3
Rate: 5 cm^3/min

d) **Start:** 30 gal
Rate: 0 gal/min

Dependent variable = Initial value + Rate × Independent Variable

a) $V = 8 + 3t$

b) $V = 540 - 20t$

c) $V = 0 + 5t$
$[V = 5t]$

d) $V = 30 + 0t$
$[V = 30]$

4. For each of the following linear relations, state the start value (initial value) and the rate of change. It is not necessary to include units in your answers.

a) $V = 50 + 2t$

Initial value = 50
R of C = 2

b) $V = 50 - 2t$

Initial value = 50
R of C = -2

c) $A = 350 + 40n$

Initial value = 350
R of C = 40

d) $p = 10n + 25$

Initial value = 25
R of C = 10

e) $y = 125x - 30$

Initial value = -30
R of C = 125

f) $d = -\frac{2}{3}n - 90$

Initial value = -90
R of C = $-\frac{2}{3}$

g) $v = -9.8t$

Initial value = 0
R of C = -9.8

h) $d = 16$

Initial value = 16
R of C = 0

5. You can estimate your maximum heart rate, in beats per minute (bpm), by subtracting your age from 220.

a) Create an equation to model maximum heart rate (H) for a given age (x).

b) Use your equation to estimate your maximum heart rate.

a) Initial value = 220

Rate of change = −1 per year

$\Longrightarrow H = 220 + (-1)(x)$

$H = 220 - x$

b) Max heart rate = 220 − "your age"

7. For each of the following linear relations,

i) state the initial value.

ii) state the rate of change.

iii) determine an equation to model the relationship.

a)

Time (s)	Distance (m)
0	20
1	50
2	80
3	110
4	140

1 < > 30

b)

Number of People	Cost ($)
0	100
10	250
20	400
30	550
40	700

10 < > 150

c)

Time (min)	Depth (m)
0	110
5	90
10	70
15	50
20	30

d)

Volume (gal)	Mass (lb)
0	0
20	124
40	248
60	372
80	496

Initial value is the dependent value when the independent value is zero

Rate of change $= \frac{\text{rise}}{\text{run}}$

a) Initial value = 20

$R of C = \frac{30}{1}$

$= 30$

$\Longrightarrow d = 20 + 30t$

b) Initial value = 100

$R of C = \frac{150}{10}$

$= 15$

$\Longrightarrow C = 100 + 15n$

7. For each of the following linear relations,

i) state the initial value.
ii) state the rate of change.
iii) determine an equation to model the relationship.

a)

Time (s)	Distance (m)
0	20
1	50
2	80
3	110
4	140

b)

Number of People	Cost ($)
0	100
10	250
20	400
30	550
40	700

c)

Time (min)	Depth (m)
0	110
5	90
10	70
15	50
20	30

5 < > -20

d)

Volume (gal)	Mass (lb)
0	0
20	124
40	248
60	372
80	496

20 < > 124

Initial value is the dependent value when the independent value is zero

Rate of change $= \frac{\text{rise}}{\text{run}}$

c) Initial value $= 100$

R of C $= \frac{-20}{5}$

$= -4$

$\Rightarrow d = 100 + (-4)(t)$

$d = 100 - 4t$

d) Initial value $= 0$

R of C $= \frac{124}{20}$

$= \frac{31}{5}$

$\Rightarrow m = 0 + \frac{31}{5}v$

$m = \frac{31}{5}v$ or $6.2v$

10. Initially, only one person in a small town is infected with a virus. With each passing day, the number of infected people doubles.

a) Create a table of values to show the number of infected people in the town from day 0 through day 7.

Initial value = 1

Rate of change = DOUBLING.

Days	People infected
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128

10. Initially, only one person in a small town is infected with a virus. With each passing day, the number of infected people doubles.

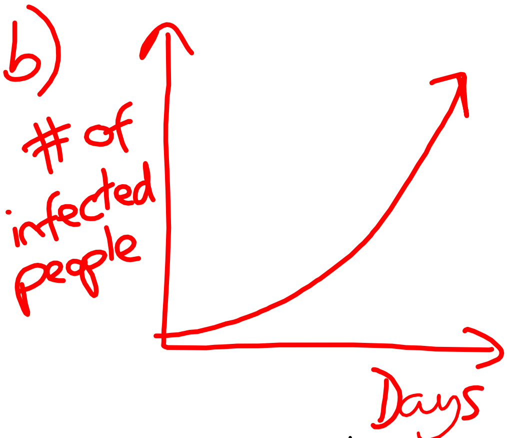
b) Use your table of values to sketch a graph of this relation.

c) Is the relationship between the number of infections and the number of days linear or non-linear? Explain.

d) Calculate the first differences for the table. Do you notice a pattern?

e) Suggest an equation that could be used to relate the number of infected people to the number of days passed.

b)



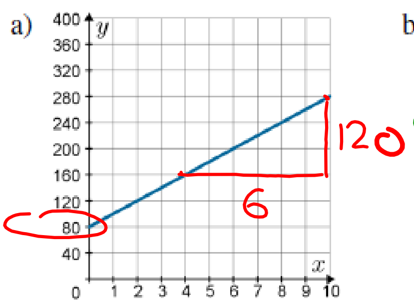
c) Non-linear. Rate of change is not constant.

d) The differences have the same values as the number infected.

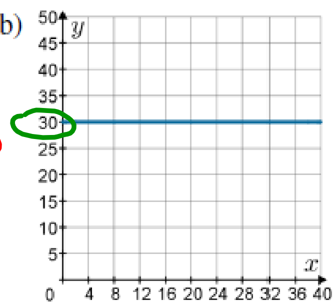
e) $I = 2^d$ $\quad I = \#$ infected, $d = \#$ of days

14. Each of the following describes a linear relation between the variables x and y. Determine an equation to model each relationship.

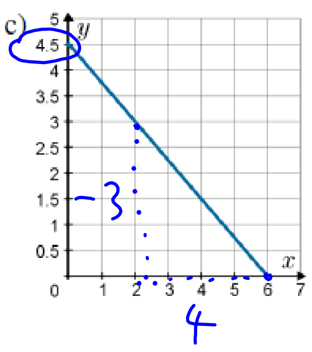
a)



b)



c)



a) Initial value $= 80$

R of C $= \frac{120}{6}$

$= 20$

$\Rightarrow y = 80 + 20x$

b) Initial value $= 30$

R of C $= 0$

(horizontal)

$\Rightarrow y = 30 + 0x$

$y = 30$

c) Initial value $= 4.5$

R of C $= \frac{-3}{4}$

$\Rightarrow y = 4.5 - \frac{3}{4}x$

14. Each of the following describes a linear relation between the variables x and y. Determine an equation to model each relationship.

2

d)

x	0	2	4	6	8	10	12
y	0	–15	–30	–45	–60	–75	–90

-15

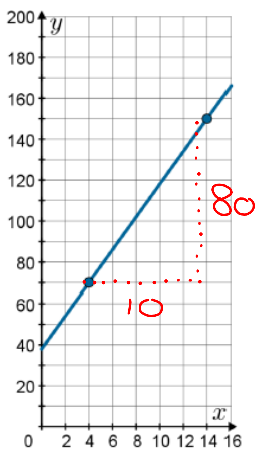
Initial value $= 0$

R of $C = -\frac{15}{2}$

$\Rightarrow y = 0 + \frac{-15}{2}x$

$y = -\frac{15}{2}x$

17. Find an equation for the linear relation shown in the graph on the right.



R of $C = \frac{80}{10}$

$= 8$

Initial value $= ?$ (looks just less than 40)

<u>Check</u> $y = ? + 8x$

using the point from the graph $(4, 70)$

$\Rightarrow 70 = ? + 8(4)$

y x

$70 = ? + 32$

$70 - 32 = ? + 32 - 32$

$38 = ?$

$\Rightarrow$ Equation is $y = 38 + 8x$