3.8 HOMEWORK HANDOUT – LINEAR MODELS

PART A

1) A taxi service charges an initial fee of $5.00, plus $2.00 for each kilometre travelled.
   a) Complete a table of values showing the total cost of hiring the taxi service for 0, 1, 2, 3, 4 and 5 kilometres.
   b) Sketch a graph to show the total cost of using the taxi service up to a distance of 10 kilometres.
   c) Identify the start value and rate of change for the total cost of using the taxi service.
   d) Create an equation to model the total cost, C, of using the taxi service for a distance of d kilometres.
   e) Use one of your representations from parts (a), (b) and (c) to determine the total cost of a 50 km taxi ride.

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.
   d) Create an equation to model the number of candies in the jar, n, after t days.
   e) For what values of t does your equation apply?

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

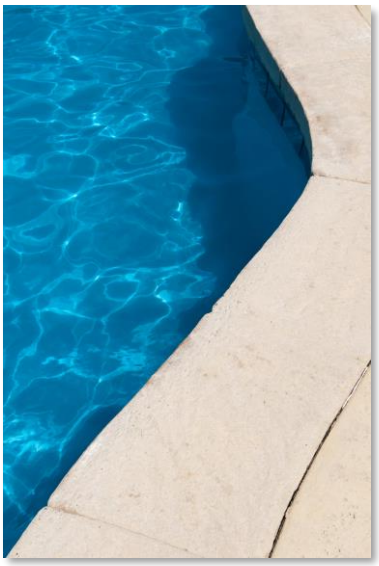
4) For each of the following linear relations, state the start value (initial value) and the rate of change. It is not necessary to include units in your answers.

   a) $V = 50 + 2t$
   b) $V = 50 - 2t$
   c) $A = 350 + 40n$
   d) $p = 10n + 25$
   e) $y = 125x - 30$
   f) $d = -\frac{2}{3}n - 90$
   g) $v = -9.8t$
   h) $d = 16$

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.

PART B

6) When a swimming pool is first opened for the season, it already contains 10 000 gallons of water. Water is added to the pool using a garden hose from which water flows at a rate of 500 gallons per hour. Filling continues until the pool contatains 14 500 gallons of water.



a) Complete a table of values showing the volume of water in the pool every hour from when filling begins to when it is complete.

b) How long does it take to fill the pool?

c) Sketch a graph to display the volume of water in the pool as it is filled.

d) Use your graph to estimate the volume of water in the pool four and a half hours after filling begins.

e) Create an equation to model the volume of water in the pool t hours after filling begins.

f) What values can be used for t in your equation?

g) Create another equation for the volume of water in which t represents the number of minutes after filling begins.

h) Use your equation to determine the volume of water in the pool 375 minutes after filling begins.

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

d)

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

.e)

x	y
1	15.6
2	24.3
3	33.0
4	41.7
5	50.4

f)

x	y
20	1800
40	1510
60	1220
80	930
100	640

g)

x	y
50	692
40	569
30	446
20	323
10	200

h)

x	y
2	–380.5
7	–338.0
12	–295.5
17	–253.0
22	–210.5

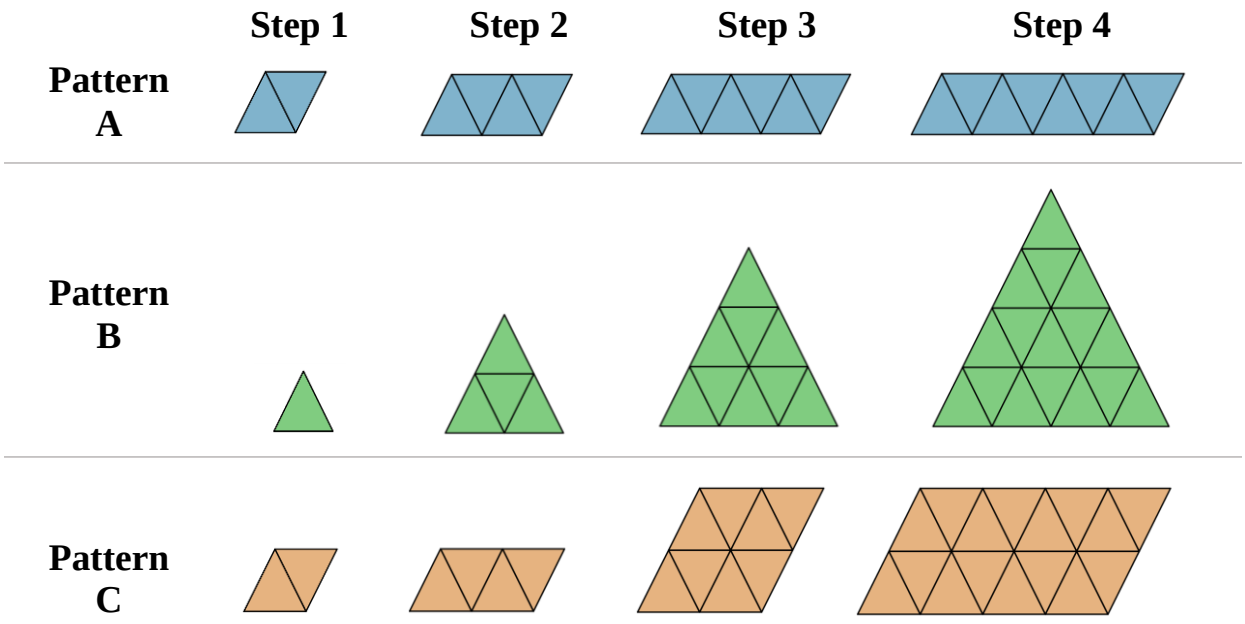
8) Mia walks at a speed of 2.5 m/s on a straight path from her home to her school, a total distance of 340 m.

a) Find an equation to model Mia's distance **from home** (d) after she's been walking for t seconds.

b) Find an equation to model Mia's distance **from the school** (d) after she's been walking for t seconds

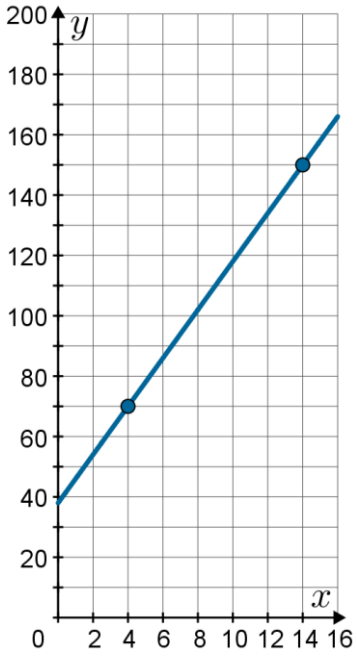
PART C

9) Consider the following patterns:



a) Create a table of values for each pattern, showing the number of small triangles needed at each step from the first step through the seventh step.
b) For each pattern, state whether the rate of change is constant, increasing or decreasing.
c) Hypothesize the number of small triangles needed for Step 0 of each pattern.
d) Which pattern will require the least number of small triangles at step 15?
e) Which pattern will require the greatest number of small triangles at step 15?
f) For each pattern, determine an equation that could be used to model the number of small triangles (n) required for each step (s).

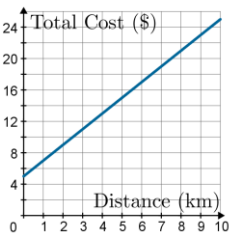
10) Find an equation for the linear relation shown in the graph on the right.



ANSWERS

1) a)

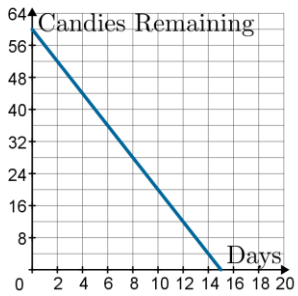
Distance (km)	Total Cost ($)
0	5.00
1	7.00
2	9.00
3	11.00
4	13.00

b) 

c) Start value: $5.00 Rate: $2.00/km
d) C= 2a+5
e) $105.00

2) a)

Number of Days	Candies in Jar
0	60
1	56
2	52
3	48
4	44
5	40
6	36

b) 

c) Initial value: 60 candies
Rate: –4 candies/day
d) n= -4t + 60
e) whole numbers from 0 through 15

3) a) V= 3t+8 b) V= -20t + 540 c) $V = 5t$ d) $V = 30$

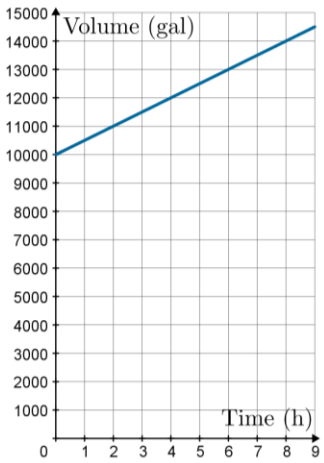
4) a) Start: 50 Rate: 2 b) Start: 50 Rate: –2 c) Start: 350 Rate: 40
d) Start: 25 Rate: 10 e) Start: –30 Rate: 125 f) Start: –90 Rate: $-\frac{2}{3}$
g) Start: 0 Rate: –9.8 h) Start: 16 Rate: 0

5) a) H= -x + 220 b) Answer depends on age. For example, for an age of 14 years, the maximum heart rate is 206 bpm.

6) a)

Time (h)	Volume (gal)
0	10 000
1	10 500
2	11 000
3	11 500
4	12 000
5	12 500
6	13 000
7	13 500
8	14 000
9	14 500

b) 9 hours

c) 

d) 12 250 gal
e) V= 500t + 10,000
f) All real numbers from 0 through 9.
g) $V = 10000 + \frac{500}{60}t$ or $V = 10000 + \frac{25}{3}t$
h) 13 125 gal

7) a) i) 20 m ii) 30 m/s iii) d=30t+20 b) i) $100 ii) $15/person iii) C=5n+100
c) i) 110 m ii) –4 m/min iii) d= -4t + 110 d) i) 0 lb ii) 6.2 lb/gal iii) $M = 6.2V$
e) i) 6.9 ii) 8.7 iii) y=8.7x + 6.9 f) i)2090 ii) -14.5 iii) y= -14.5x + 2090 g) i) 77 ii) 12.3 iii) y= 12.3x + 77 h) i) -397.5 ii) 8.5 iii) y = 8.5x- 397.5

8) a) $d = 2.5t$ b) d= -2.5t + 340

9) a) Pattern A:

Step	Number of Triangles
1	2
2	4
3	6
4	8
5	10
6	12
7	14

Pattern B:

Step	Number of Triangles
1	1
2	4
3	9
4	16
5	25
6	36
7	49

Pattern C:

Step	Number of Triangles
1	2
2	4
3	8
4	16
5	32
6	64
7	128

b) Pattern A: constant Pattern B: increasing Pattern C: increasing
c) Pattern A: 0 Pattern B: 0 Pattern C: 1
d) Pattern A
e) Pattern C
f) Pattern A: $n = 2s$ Pattern B: $n = s^2$ Pattern C: $n = 2^s$

10) y =8x + 38