GRADE 9 MATH - LINEAR RELATIONS

KEY TERMS :

- linear relation
- linear equation
- numerical coefficient
- variables
- constant
- interpolate
- extrapolate

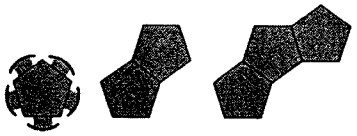
Students will generalize a pattern arising from a problem-solving context, using a linear equation, and verify by substitution.

Students will graph a linear relation, analyze the graph, and interpolate or extrapolate to solve problems.

Key Ideas

- Many pictorial and written patterns can be represented using a table of values or a linear equation.

  The pentagonal table can seat five people. The tables can be connected to form longer tables.



Number of Tables, t	Number of Sides, s	Pattern: Multiply t by 3 and Add 2
1	5	5
2	8	8
3	11	11

  The equation that models the pattern is $s = 3t + 2$.

- Linear equations can be verified by substituting values.

  Substitute $t = 3$ into the equation:

  $s = 3(3) + 2$

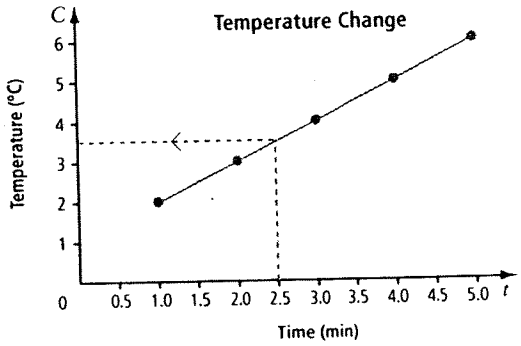
  $= 9 + 2$

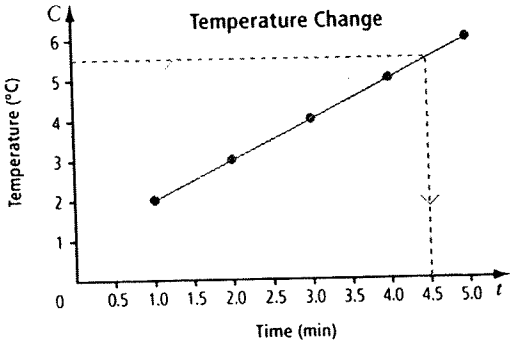
  $= 11$

  The calculated value matches the value in the table.

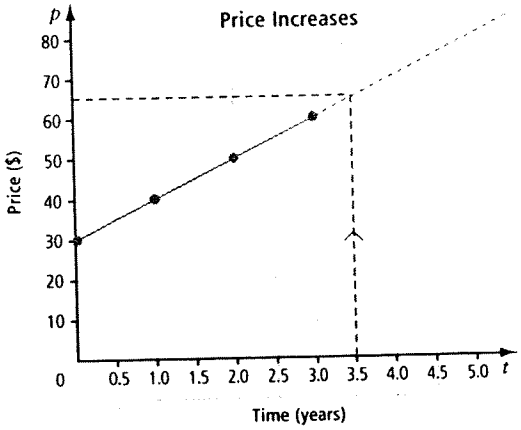
Key Ideas

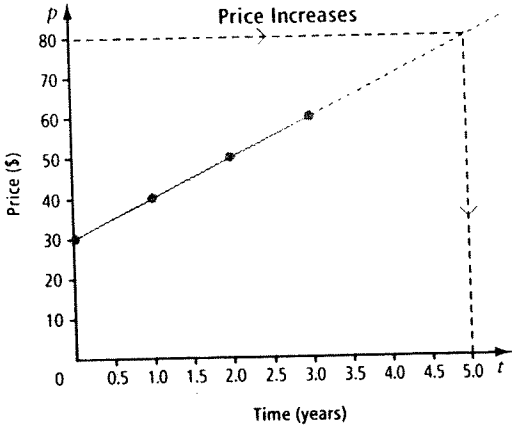
- On a graph, you can use a line to interpolate values between known values.
  - Start with a known value for x.
  - Start with a known value for y.





- On a graph, you can extend a line to extrapolate values beyond known values.
  - Use a dashed line to extend the line beyond the known x-value or y-value.
  - Start with a known value for x.
  - Start with a known value for y.





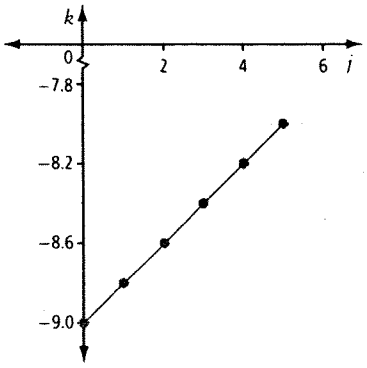
- Interpolation and extrapolation should be used only when it is reasonable to have values between or beyond the values on a graph.

Key Ideas

- You can graph a linear relation represented by an equation.
  - Use the equation to make a table of values.
  - Graph using the coordinate pairs in the table. The graph of a linear relation forms a straight line.

$k = \frac{j}{5} - 9$

j	k
0	−9.0
1	−8.8
2	−8.6
3	−8.4
4	−8.2
5	−8.0



  - The graph of a linear relation can form a horizontal or a vertical line.
- You can use graphs to solve problems by interpolating or extrapolating values.

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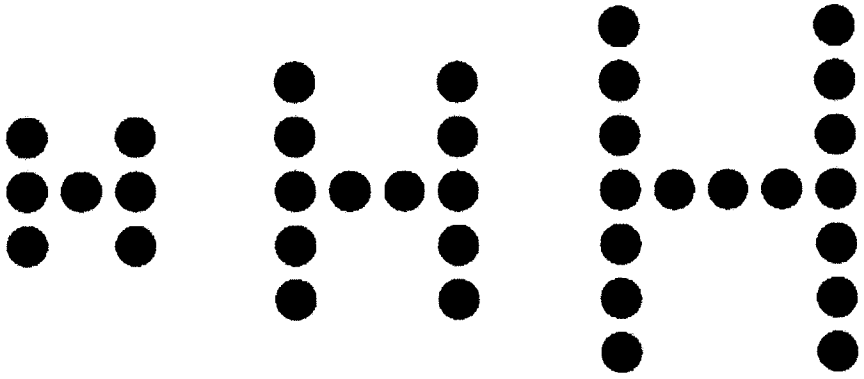
gr 9 math review linear relations

Multiple Choice
Identify the choice that best completes the statement or answers the question.

Use the figures to answer the following question(s).

Figure 1 Figure 2 Figure 3



____ 1. Which table of values represents the number of dots in the pattern?

a.

Figure Number	Number of Dots
1	7
2	12
3	17

c.

Figure Number	Number of Dots
1	5
2	10
3	15

b.

Figure Number	Number of Dots
1	7
2	10
3	13

d.

Figure Number	Number of Dots
1	6
2	10
3	14

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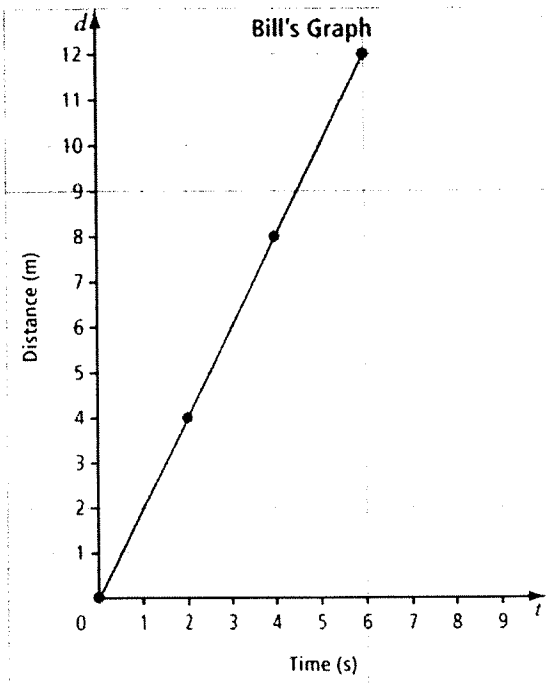
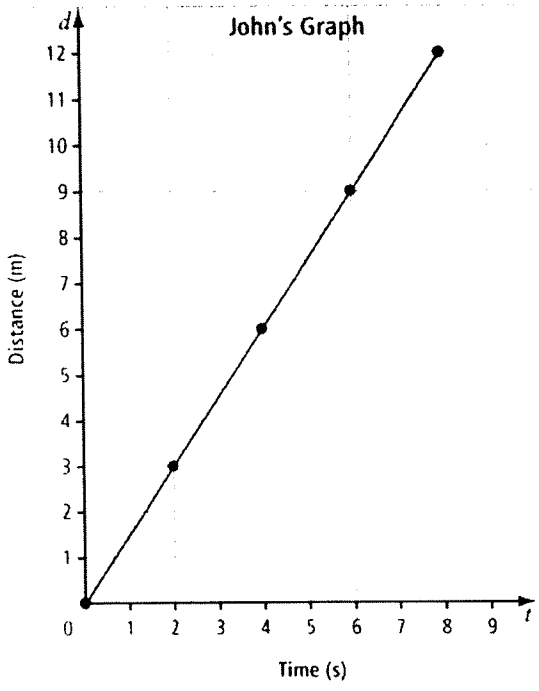
Use the graphs to answer the following question(s).





____ 2. Which linear relation represents John's graph?

a. $d = 1.5t$
b. $d = 1.5t + 1.5$
c. $d = 3t$
d. $d = 3t + 3$

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Use the figures to answer the following question(s).

Figure 1

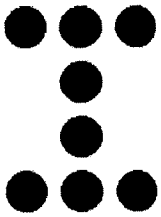


Figure 2

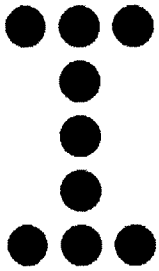
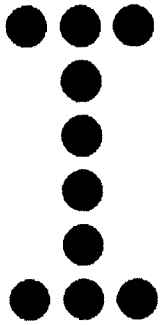


Figure 3



____ 3. Which table of values describes the pattern?

a.

Figure Number	Number of Dots
1	8
2	9
3	10

c.

Figure Number	Number of Dots
1	10
2	12
3	14

b.

Figure Number	Number of Dots
1	8
2	10
3	12

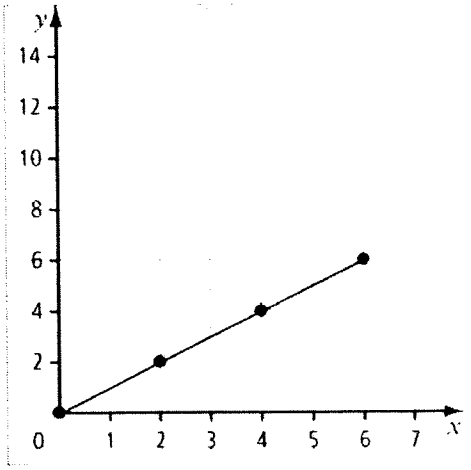
d.

Figure Number	Number of Dots
1	4
2	5
3	6

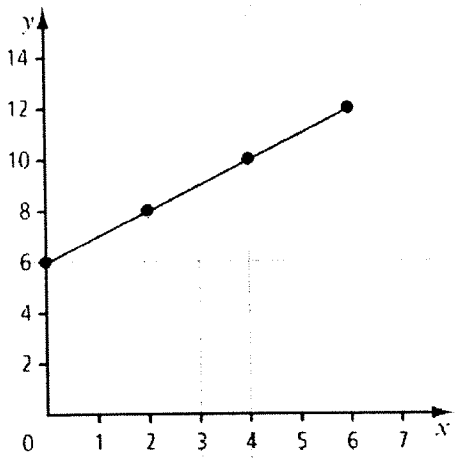
____ 4. Which graph represents the following table of values?

x	y
6	0
4	2
2	4
0	6

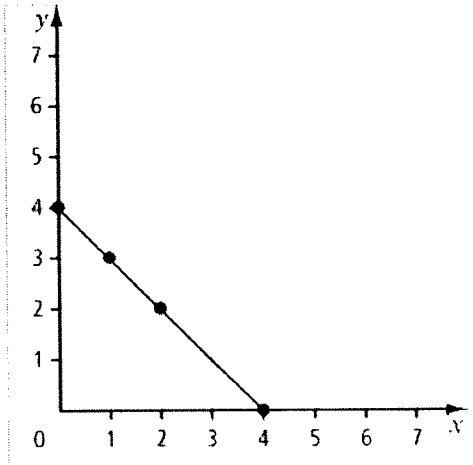
a.



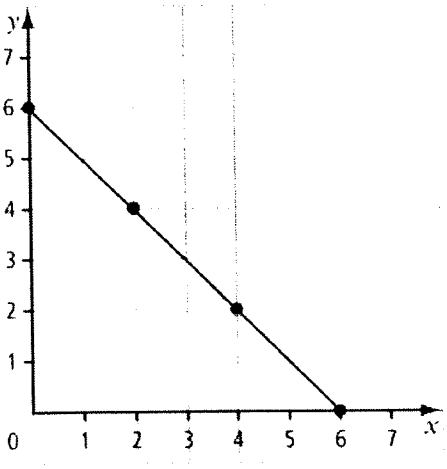
c.



b.



d.



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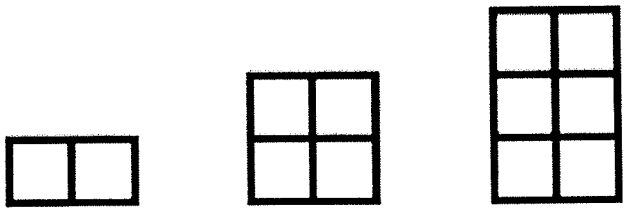
Short Answer

5. Each square in the pattern has a side length of 1 cm.

Figure 1 Figure 2 Figure 3

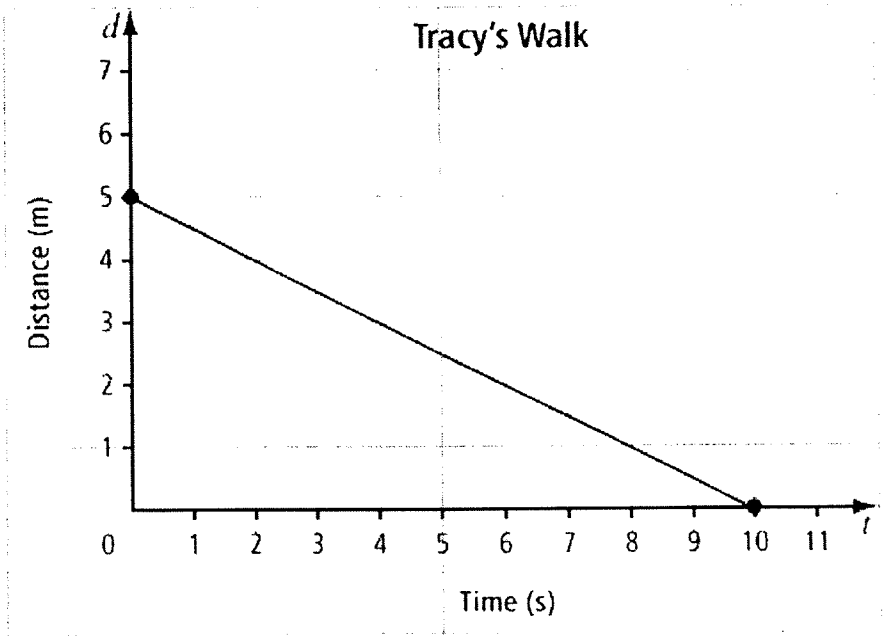


a) Create a table comparing the figure number with the area for that figure. Extend the table to include the next two figures in the pattern.
b) What is a linear equation that represents this pattern?

6. Theater tickets cost $65.00 each. Complete the table of values and develop a linear equation that relates the cost to the number of tickets.

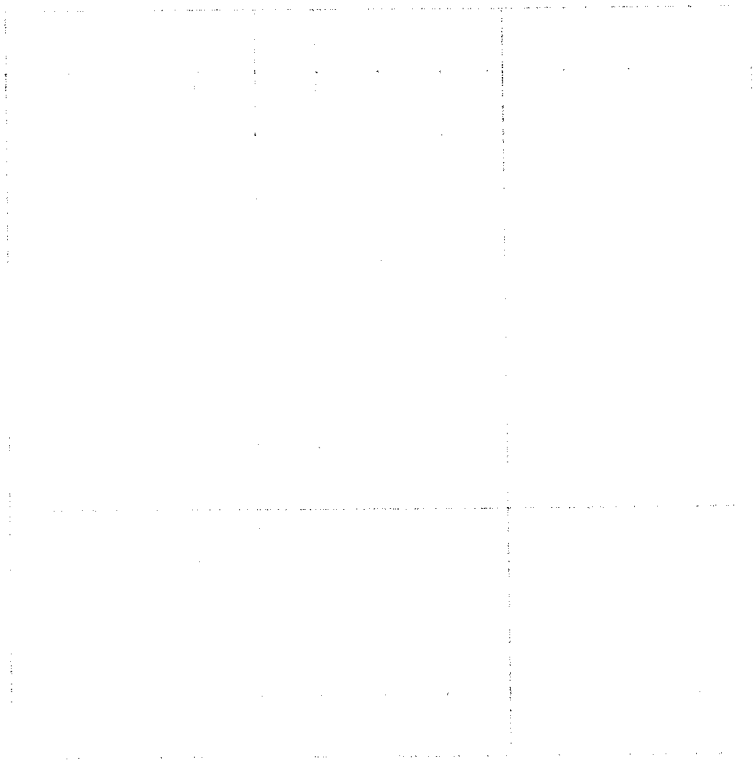
Number of Tickets, n	Cost, c ($)
1	
2	
3	
4	
5	

7. Tracy is walking near a motion detector.
   a) How far was Tracy from the sensor when she began walking?
   b) Was she walking toward or away from the motion sensor at the time?
   c) How long did it take her to reach the motion sensor?



8. **a)** What is the linear equation of the vertical line that passes through the point (3, 4)?
   b) What is the linear equation of the horizontal line that passes through the point (3, 4)?

9. A long distance phone plan charges a flat fee of \$8 per month, plus \$0.10 per minute of call time.
   a) Write a linear equation to represent the relationship between the number of minutes of call time, n, and the total monthly cost, c.
   b) Graph the linear relation using 0 min as the first point and 80 min as the last.



   c) What is the total cost for a month where the call time is 75 min?

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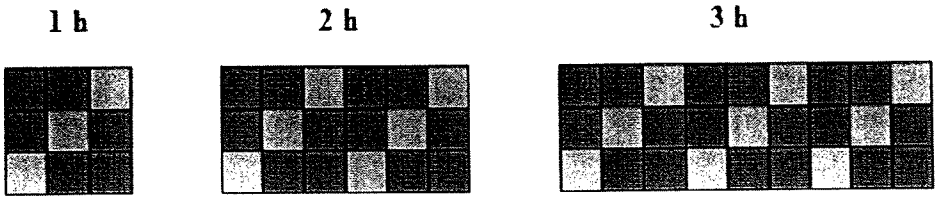
Problem

10. Abby and Braden are tiling a floor. All tiles are square. The figure below shows how many tiles Abby and Braden put in place, by the hour.



a) Complete the table of values.

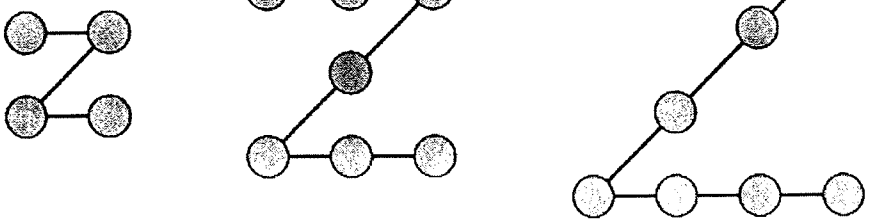
Hours Worked	1	2	3	4	5
Number of Light Grey Tiles					
Number of Dark Grey Tiles					

b) How many light grey tiles have been laid in five h?

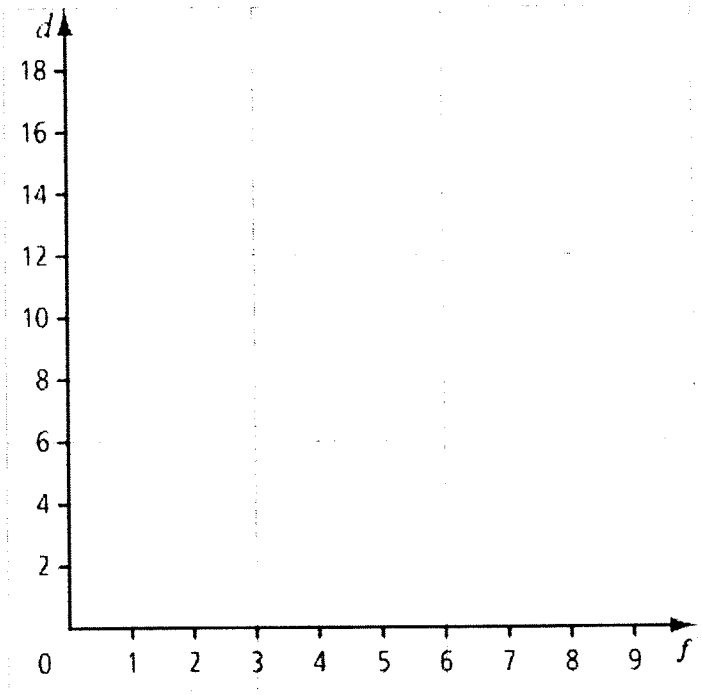
c) If there are 60 dark grey tiles to be laid, how long did it take to complete the work?

11. The letter Z is constructed from dots. The first three diagrams are shown below.

Figure 1 Figure 2 Figure 2



a) Draw the next diagram.
b) Create a table of values showing the relationship between the figure number, f, and the number of dots, d, for the first four figures.
c) Graph the table of values.

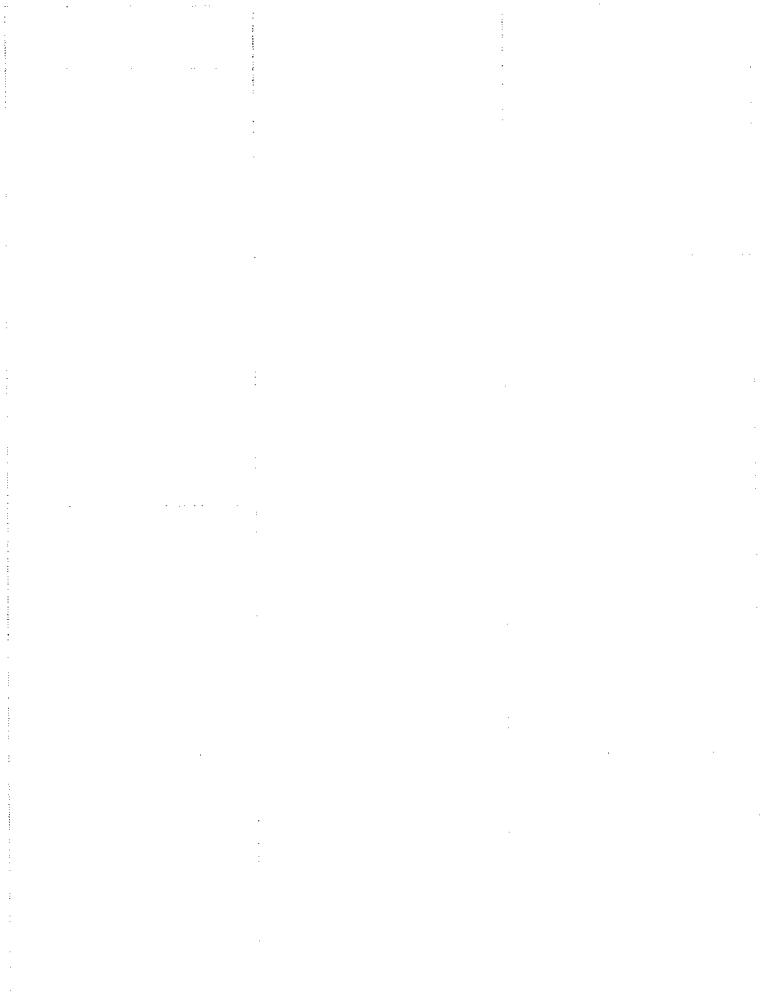


d) Describe the relationship between the figure number and the number of dots.
e) What is the equation that represents the relationship between the figure number, f, and the number of dots, d?
f) How many dots would be in Figure 8?

12. A computer repair shop charges a flat fee of $50.00 plus $25.00 per half hour of labour required to complete the repair.

a) Create a table of values showing the relationship between the required repair time, t, and the cost of repairs, c, from 0 to 4 h, in half-hour intervals.

b) Draw a graph of the table of values.



c) What is the cost of a repair that took 3 h to complete?

d) Extrapolate from the graph to determine how many hours were required for a repair costing $400.

13. A jet flies from Toronto to Rome. Its flight can be modelled by the linear equation $d = 7200 - 800t$, where d is the distance, in kilometres, from Rome and t is the time, in hours.
a) Graph the linear relation.
b) How long does it take to fly 4000 km?