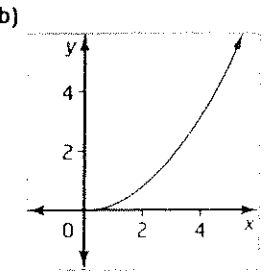


Chapter 1 Quadratic Functions

1. Determine if each relation is a function. How do you know?
- a) 

x	y
0	1
2	3
4	5
6	7
4	9
2	11
- b) 
- c)  $x + 2y = 4$       d)  $y = (x - 1)^2$
2. For each function in question 1, write the domain and range.
3. Evaluate, given  $f(x) = 2x^2 - 3x + 1$ .
- a)  $f(0)$       b)  $f(0.5)$       c)  $f(-2)$
4. The height  $h(t)$ , in metres, of a ball  $t$  seconds after being thrown is modelled by the function  $h(t) = -4.9t^2 + 100$ .
- a) Describe in words the meaning of  $h(1)$  in this context.
- b) What is the height of the ball 3 s after it is thrown?
- c) What is the maximum height of the ball?
- d) Write the range of the function.
5. For each function, describe the graph in terms of transformations on the graph of  $y = x^2$ , then, sketch the graph. Label the vertex, axis of symmetry, and two other points on the curve.
- a)  $f(x) = -x^2 + 2$     b)  $g(x) = 2(x - 1)^2 + 3$
6. Determine the equation of a parabola that
- has vertex  $(-3, 1)$
  - is congruent to the graph of  $y = x^2$
  - has no  $x$ -intercepts

7. The graph of the function  $f(x) = x^2$  is compressed vertically and then translated 1 unit to the left and 2 units down. If the  $x$ -intercepts of the resulting graph are  $-3$  and  $1$ , find an equation for the function after these transformations.

Chapter 2 Factor Quadratic Expressions

8. For the graph of the quadratic function  $f(x) = (x - 3)^2 + 4$ , identify
- a) the direction of opening
- b) the coordinates of the vertex, and whether it is a maximum or a minimum value
- c) the axis of symmetry
- d) the  $y$ -intercept
9. a) Build or draw an algebra tile model to represent the quadratic function  $g(x) = (x + 5)^2 + 1$ .
- b) Use the model to express this function in standard form.
- c) Identify the coefficients  $a$ ,  $b$ , and  $c$ .
- d) What is the  $y$ -intercept?
10. Graph the function  $y = 2(x - 3)(x + 5)$ . Indicate the axis of symmetry, the  $x$ -intercepts, and the  $y$ -intercepts.
11. Write each function in factored form. Then, identify the  $x$ -intercepts and graph the function.
- a)  $y = 4x^2 - 4x - 15$
- b)  $f(x) = 3x^2 - 2x - 8$
- c)  $y = 5x^2 + 22x + 21$
- d)  $g(x) = 6x^2 + 10x - 4$
12. Factor fully.
- a)  $4x^2 + 28x + 49$     b)  $9y^2 - 6y + 1$
- c)  $5z^2 - 40$       d)  $75w^3 - 12w$
13. Show that the function  $y = x^2 - 20x + 100$  has only one  $x$ -intercept.

14. The position of an object moving along a straight line, undergoing constant acceleration, is given by the function  $p(t) = x_0 + v_0t + \frac{1}{2}at^2$ , where
- $t$  is the time, in seconds
  - $p(t)$  is the position of the object, at time  $t$
  - $x_0$  is its original position, in metres
  - $v_0$  is its original speed, in metres per second
  - $a$  is its acceleration, in metres per second squared
- An object thrown straight up into the air undergoes a constant acceleration of approximately  $-10 \text{ m/s}^2$  as it rises and then returns to the ground. A stone is thrown straight up into the air with an initial upward speed of  $1 \text{ m/s}$  and an initial position  $6 \text{ m}$  above ground. Find the length of time the stone is in the air.

Chapter 3 Represent Quadratic Functions

15. Rewrite each quadratic function in vertex form  $y = a(x - h)^2 + k$  by completing the square.
- a)  $y = 3x^2 - 12x + 7$
- b)  $y = \frac{1}{3}x^2 - 6x + 2$
- c)  $y = -4x^2 + x - 3$
16. Solve using the quadratic formula. Express answers as exact roots and as approximate roots, rounded to the nearest hundredth.
- a)  $5x^2 + 4x - 1 = 0$
- b)  $-\frac{1}{2}x^2 + \frac{2}{3}x + 4 = 0$
17. Determine how many real roots each equation has and then solve. Round answers to the nearest hundredth, when necessary.
- a)  $2x^2 + 15x + 7 = 0$
- b)  $9x^2 - 30x + 25 = 0$
- c)  $x^2 + 6x + 3 = 0$

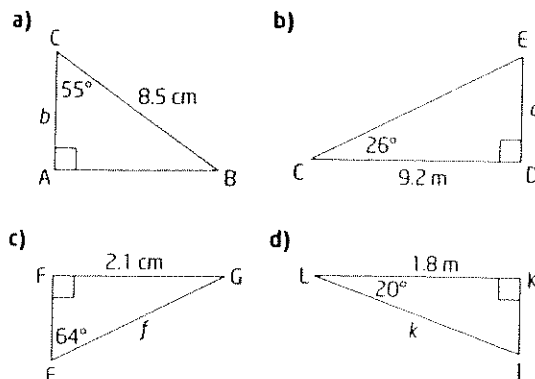
18. Determine key features of each graph. Find the  $x$ -intercepts, the  $y$ -intercept, the coordinates of the vertex, and the equation of the axis of symmetry. Then, sketch the graph and label the features.
- a)  $y = -5x^2 + 10x + 75$
- b)  $y = 2x^2 + 2x - 3$
- c)  $y = x^2 + 6x - 9$
- d)  $y = 4x^2 + 5x - 4$
19. Determine the intervals for which the function  $y = x^2 + 2x - 15$  is increasing or decreasing and the intervals for which the function is positive or negative.
20. A baseball follows a quadratic path, where  $h$  is the height of the baseball, in metres, and  $d$  is the horizontal distance, in metres, that the baseball travels after it is batted.

d	h
0.0	1.1
1.9	22.3
2.8	30.1
3.5	32.5
4.1	32.9
5.9	26.5
7.5	8.7

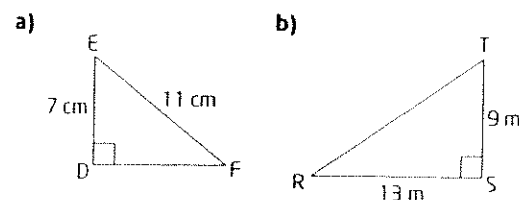
- a) Make a scatter plot of the data.
- b) Estimate the coordinates of the vertex and find an equation that models the data.

## Chapter 4 Trigonometry

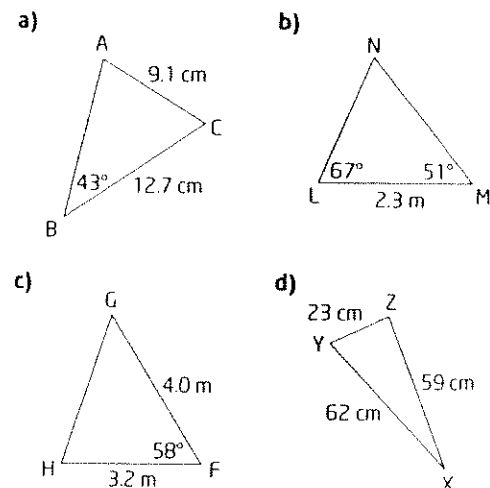
1. Find the length of the indicated side, to the nearest tenth of a unit.



2. Find the measure of both acute angles in each triangle, to the nearest degree.



3. Solve each triangle. Round your answers to the nearest tenth of a unit, if necessary.



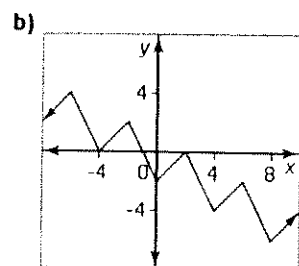
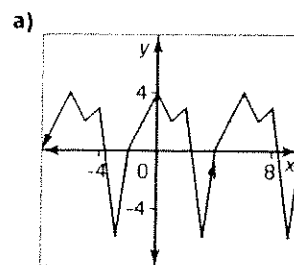
4. When a cat is 7 m from a fence, the angle of elevation to the top of the fence is  $16^\circ$ . What is the angle of elevation when the cat is 3 m from the fence? Round to the nearest degree.

5. Two scuba divers are 100 m apart at the same depth beneath the water's surface. Their boat is located between the two divers at an angle of elevation of  $60^\circ$  from diver A and  $54^\circ$  from diver B. How far is each diver from their boat, to the nearest metre?

6. The posts of a soccer goal are 7.3 m apart. Marta is 12.5 m from one post and 13.2 m from the other post. Within what angle, to the nearest degree, must she kick the soccer ball to score a goal?

## Chapter 5: Sine Functions

7. Determine whether or not each graph is periodic. If it is, determine the period, amplitude, domain, and range.



8. The table shows the number of international travellers visiting Canada from Europe quarterly from 2005 to 2006.

Quarterly Period	Number of Travellers (1000s)
March 2005	327
June 2005	607
September 2005	1034
December 2005	405
March 2006	319
June 2006	616
September 2006	996
December 2006	403

Source: Statistics Canada, CANSIM table 387-0004

- a) Make a scatter plot of the data and draw a curve of best fit.  
b) Does this represent a periodic function? Explain your reasoning.  
c) What are the maximum and minimum numbers of travellers? When do they occur?  
d) Predict the maximum number of travellers for the year 2010. How accurate is your prediction? Explain your reasoning.

- Which pairs of angles are coterminal? Justify your answer.

- a)  $40^\circ$  and  $220^\circ$  b)  $65^\circ$  and  $785^\circ$   
c)  $115^\circ$  and  $-245^\circ$  d)  $-35^\circ$  and  $-235^\circ$

- Determine the measure of angle  $\theta$  in standard position, correct to one decimal place.

- a)  $\sin \theta = 0.7660$ , if  $\theta$  is in the second quadrant  
b)  $\sin \theta = -0.8910$ , if  $\theta$  is in the third quadrant  
c)  $\tan \theta = -0.3640$ , if  $\theta$  is in the fourth quadrant  
d)  $\cos \theta = -0.8660$ , if  $\theta$  is in the third quadrant

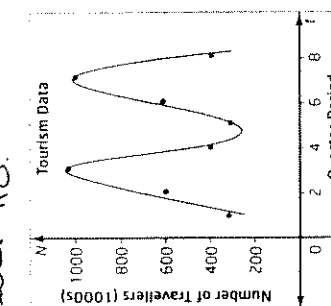
12. Draw a sketch of  $y = \sin x$  for one period.

- a) Locate all the points where  $y = 0$  and give the values of  $x$ .  
b) Locate all the points where  $y = 0.8660$  and give the values of  $x$ .  
c) Locate all the points where  $y = -0.7071$  and give the values of  $x$ .

13. Sketch a graph of each function for one cycle. Determine the period, amplitude, phase shift, domain, range, and the equation of the horizontal axis.

- a)  $y = \sin x + 3$  b)  $y = -2 \sin x$   
d)  $y = \sin(x + 30^\circ)$

Answer #8.

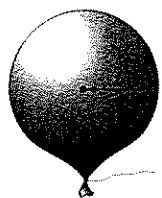


b) a periodic function

- c) the maximum number of travellers was 1 034 000 in September 2005, the minimum number of travellers was 319 000 in March 2006  
d) Predictions will vary. For example, the maximum number of travellers in the year 2010 will be approximately 1 000 000.

## Chapter 6 Exponential Functions

1. Gus fills a spherical balloon with helium to a volume of  $20\,000\text{ cm}^3$ .
  - a) Use the formula  $r = \left(V \frac{3}{4\pi}\right)^{\frac{1}{3}}$  to find the radius of the balloon in centimetres.



- b) If Gus doubles the volume of helium in the balloon, what will be its radius?
2. The telephone tree for a factory with 2000 employees starts with the manager, who calls 3 people in the first “branch” of the tree. Each of those employees calls 3 more people in the second branch, and so on.
  - a) How many employees are in the third branch?
  - b) How many employees will have been called when the third branch is complete? (Include the manager and the employees in the first and second branches.)
  - c) Use an exponential function to model the number of employees in branches of the telephone tree.
  - d) How many branches of the tree does it take to contact everyone in the factory?
  - e) If the manager calls 4 people, each of whom calls 4 other people, and so on, how many branches does it take to contact everyone in the factory?
3. The current population of Earth is about 6.5 billion.
  - a) Use an average growth rate of 1.14% to estimate the population 100 years ago to the nearest tenth of a billion.
  - b) Check your answer from part a) using the library or a search engine on the Internet.

4. At 11 P.M. Inspector Mortrade was called to investigate a suspected murder on Brixton Road. She measured the temperature of the victim and found that it was  $32^\circ\text{C}$ . She knew that normal body temperature is  $37^\circ\text{C}$ , and it drops by a maximum of 5% every hour. The temperature in the room was  $17^\circ\text{C}$ .
  - a) Model the cooling curve using an exponential decay function.
  - b) Show that your model predicts a temperature of  $37^\circ\text{C}$  at  $t = 0\text{ h}$ .
  - c) Show that your model predicts that the temperature will never drop below  $17^\circ\text{C}$ .
  - d) A key witness claims to have seen the victim alive at 8 P.M. Is the witness lying? Justify your answer.

## Chapter 7 Compound Interest

5. Calculate the interest earned on each investment. Then determine the final amount of each investment.
  - a) \$2000 at 7% simple interest per year for 3 years
  - b) \$950 invested for 6 years at an annual interest rate of 5.25%, compounded semi-annually
  - c) \$2700 earning 3.3% compounded per year for 6 years
  - d) a \$4500 investment earning 6.75% annual interest over a 6-month period where interest is compounded monthly
6. Ron invests \$1050 in an account that earns 4.75% simple interest per year, for 6 years.
  - a) How much money does Ron need to add to the principal after one year to double the final value of the investment?
  - b) Suppose Ron invested \$1050 at 5.65% annual interest, with interest compounded quarterly. How much will the investment be worth after 4 years?

7. In order to save for a vacation, Kamiko wishes to borrow \$7000. She has found two options.
  - A: a one-year loan at an annual interest rate of 8.5%, compounded monthly
  - B: a one-year loan at 8.75% interest per year, with quarterly compounding. The loan must be paid in full at the end of the term.
  - a) Which loan should Kamiko accept? Justify your answer.
  - b) What is the difference between the two loans in the interest to be paid?
8. You need \$21 000 in 5 years to buy a new car.
  - a) How much must you invest now in a GIC paying 5.5% interest per year, compounded annually, to have the required amount?
  - b) If the GIC in part a) has interest compounded monthly, how much less will you need to invest now?

## Chapter 8 Annuities

9. Jessica has been investing \$250 per month into a fund that pays 4.6% per year, compounded monthly.
  - a) Draw a time line to represent the first 6 months of Jessica's investment.
  - b) Use a compound interest formula to calculate the value of Jessica's fund after 6 months.
  - c) If Jessica's fund paid 4.7% per year, compounded monthly, how much more would she have earned after 6 months?
10. Clark built an addition to his house and needs to furnish a new guest room. A furniture store is offering a new bedroom set at \$99 per month, for 12 months. If furniture store calculates interest at 17.2% per year, compounded monthly, how much would the furniture cost on the day of purchase?

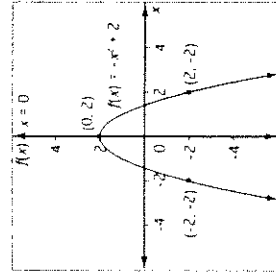
11. Hannah has 7 years to repay a \$23 000 loan at 6% per year, compounded monthly.
  - a) Use a TVM Solver to calculate her monthly payment.
  - b) What is the total amount paid on the loan?
  - c) How much interest will Hannah pay over the life of the loan?
12. While researching mutual funds on the Internet, Natasha, aged 17, found a fund that averaged a 14.45% annual return for the last 5 years. Assume that Natasha's money can continue to earn this rate of return.
  - a) What annual investment would Natasha need to make to have \$750 000 by the time she turns 60?
  - b) What annual investment should she make to have \$750 000 by the time she turns 50?
  - c) Calculate the total amount invested in each case.
  - d) Use a TVM Solver to calculate the number of years it would take Natasha to save \$750 000 if she is able to save \$2000 per year.
13. Min has \$590 000 in an annuity that pays 4.4% per year, compounded monthly. He wishes to make monthly withdrawals for the next 20 years beginning at the end of this month.
  - a) Determine the maximum monthly payment that Min can receive.
  - b) How much interest will he earn over the life of the annuity?
  - c) Determine the maximum monthly payment that Min would receive if the interest rate were 5% per year, compounded monthly.
  - d) Determine the maximum monthly payment Min would receive if the interest rate were 6% per year, compounded monthly.

# Answers

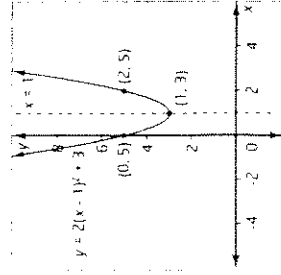
## Chapter 1 Quadratic Functions

1. a) The relation is not a function.  
b) The relation is a function.  
c) The relation is a function.  
d) The relation is a function.
2. a) Domain:  $\{0, 2, 4, 6\}$ , Range:  $\{1, 3, 5, 7, 9, 11\}$   
b) Domain:  $\{x \in \mathbf{R} \mid x \geq 0\}$ , Range:  $\{y \in \mathbf{R} \mid y \geq 0\}$
- c) Domain:  $\{x \mid x \in \mathbf{R}\}$ , Range:  $\{y \mid y \in \mathbf{R}\}$   
d) Domain:  $\{x \mid x \in \mathbf{R}\}$ , Range:  $\{y \in \mathbf{R} \mid y \geq 0\}$
3. a)  $f(0) = 1$   
b)  $f(0.5) = 0$   
c)  $f(-2) = 15$   
d)  $f(0.5) = 15$
4. a)  $h(t)$  represents the height of the ball  $t$  s after being thrown.  
b) 55.9 m  
c) 100 m  
d) Range:  $\{h \in \mathbf{R} \mid 0 \leq h \leq 100\}$

5. a) The graph of  $f(x) = -x^2 + 2$  is a reflection in the  $x$ -axis of the graph of  $f(x) = x^2$  and a translation of 2 units up.



- b) The graph of  $g(x) = 2(x - 1)^2 + 3$  is a vertical stretch of the graph of  $f(x) = x^2$  by a factor of 2 and a translation of 1 unit to the right and 3 units up.

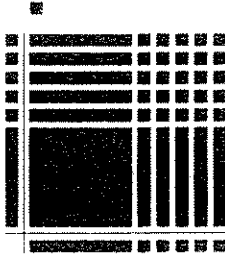


6.  $y = (x + 3)^2 + 1$   
7.  $y = \frac{1}{2}(x + 1)^2 - 2$

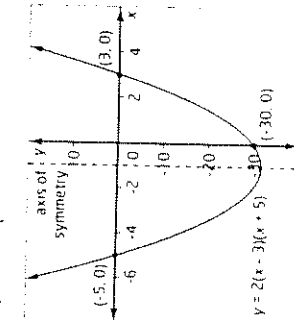
## Chapter 2 Factor Quadratic Expressions

8. a) upward  
b) minimum value:  $(3, -4)$   
c)  $x = 3$   
d)  $y$ -intercept = 13

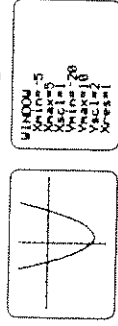
9.



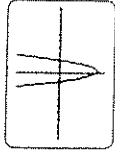
- b)  $g(x) = x^2 + 10x + 26$   
c)  $a = 1$ ,  $b = 10$ , and  $c = 26$   
d)  $y$ -intercept = 26



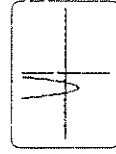
11. a)  $y = (2x - 5)(2x + 3)$ ;  $x = \frac{5}{2}$  and  $x = -\frac{3}{2}$



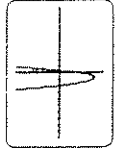
- b)  $f(x) = (x - 2)(3x + 4)$ ;  $x = 2$  and  $x = -\frac{4}{3}$



- c)  $y = (x + 3)(3x + 7)$ ;  $x = -3$  and  $x = -\frac{7}{3}$



- d)  $g(x) = (x - 1)(2x + 4)$ ;  $x = \frac{1}{2}$  and  $x = -2$



12. a)  $(2x + 7)^2$   
b)  $(3y - 1)^2$   
c)  $5(z^2 - 8)$   
d)  $3w(5w - 2)(5w + 2)$

13.  $y = (x - 10)^2$ . Since the two binomial factors are equal, there is only one  $x$ -intercept, 10.

14. 1, 2, 3

## Chapter 3 Represent Quadratic Equations

15. a)  $y = 3(x - 2)^2 - 5$   
b)  $y = \frac{1}{2}(x - 9)^2 - 25$   
c)  $y = -4\left(x - \frac{1}{8}\right)^2 - \frac{47}{16}$

16. a)  $x = -1$  and  $x = 0$

- b)  $x = \frac{2 + \sqrt{76}}{3}$  and  $x = \frac{2 - \sqrt{76}}{3}$

$$x = 3.57 \text{ and } x = -2.24$$

17. a)  $D \geq 0$ , so there are two real roots,  $-\frac{1}{2}$  and  $-7$

- b)  $D = 0$ , so there is one real root;  $\frac{5}{3}$

- c)  $D > 0$ , so there are two real roots; approximately  $-0.55$  and  $-5.45$

18. Sketches may vary.

- a)  $x$ -intercepts: 5 and  $-3$ ;  $y$ -intercept: 75; vertex:  $(1, 80)$ ; axis of symmetry:  $x = 1$

- b)  $x$ -intercepts:  $\frac{-1 + \sqrt{7}}{2}$  and  $\frac{-1 - \sqrt{7}}{2}$

$$y\text{-intercept} = 3; \text{vertex: } \left(-\frac{1}{2}, \frac{7}{2}\right)$$

$$\text{axis of symmetry: } x = -\frac{1}{2}$$

- c)  $x$ -intercepts:  $-3 + \sqrt{18}$  and  $-3 - \sqrt{18}$ ;  $y$ -intercept:  $-9$ ; vertex:  $(-3, -18)$ ; axis of symmetry:  $x = -3$

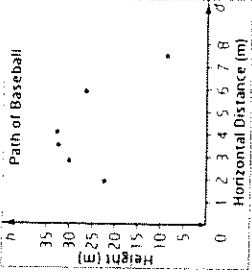
- d)  $x$ -intercepts:  $\frac{-5 + \sqrt{89}}{8}$  and  $\frac{-5 - \sqrt{89}}{8}$

$$y\text{-intercept} = -4; \text{vertex: } \left(-\frac{5}{8}, -\frac{49}{16}\right)$$

$$\text{axis of symmetry: } x = -\frac{5}{8}$$

19. When  $x < -1$  the function is decreasing; When  $x > -1$ , the function is increasing; When  $x < -5$  and  $x > 3$ , the function is positive; When  $-5 < x < 3$ , the function is negative.

20. a)



- b) Estimates and equations may vary; vertex:  $(4, 33)$ ;  $h(d) = -2(d - 4)^2 + 33$

## Chapter 4: Trigonometry

1. a) 4.9 cm b) 4.5 m c) 2.3 cm d) 1.9 m
2. a)  $\angle F = 40^\circ$ ,  $\angle E = 50^\circ$ ; b)  $\angle T = 55^\circ$ ;  $\angle R = 35^\circ$
3. a)  $\angle A = 72.1^\circ$ ,  $\angle C = 64.9^\circ$ , and  $c = 12.1$  cm  
b)  $\angle N = 62^\circ$ ,  $l = 2.4$  m, and  $m = 2.0$  m  
c)  $f = 3.6$  m,  $\angle G = 49.7^\circ$ , and  $\angle H = 72.3^\circ$   
d)  $\angle Z = 86.5^\circ$ ,  $\angle Y = 71.8^\circ$ , and  $\angle X = 21.7^\circ$
4.  $34^\circ$
5. diver A: approximately 89 m; diver B: approximately 95 m
6.  $33^\circ$

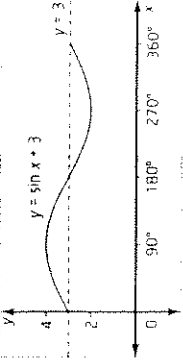
## Chapter 5: Sine Functions

7. a) periodic  
period = 6  
amplitude = 5  
domain =  $\{x \in \mathbf{R}\}$   
range =  $\{y \in \mathbf{R} \mid -6 \leq y \leq 4\}$   
b) not periodic

9. a) not coterminal  
b) coterminal  
c) coterminal  
d) not coterminal

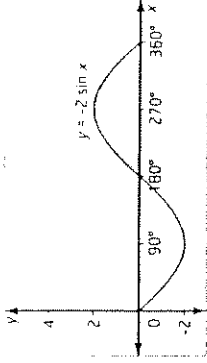
11. a)  $130.0^\circ$  b)  $243.0^\circ$  c)  $340.0^\circ$  d)  $210.0^\circ$
12. a)  $y = 0$  when  $x = 0^\circ$ ,  $180^\circ$ , or  $360^\circ$   
b)  $y = 0.8860$  when  $x = 60^\circ$  or  $120^\circ$   
c)  $y = -0.7071$  when  $x = 225^\circ$  or  $315^\circ$

13. a)



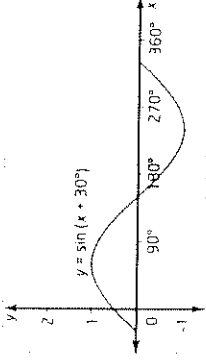
- period =  $360^\circ$   
amplitude = 1  
phase shift =  $0^\circ$   
domain =  $\{x \in \mathbf{R} \mid 0^\circ \leq x \leq 360^\circ\}$   
range =  $\{y \in \mathbf{R} \mid -2 \leq y \leq 4\}$   
The horizontal axis has equation  $y = 3$ .

b)



- period =  $360^\circ$   
amplitude = 2  
phase shift =  $0^\circ$   
domain =  $\{x \in \mathbf{R} \mid 0^\circ \leq x \leq 360^\circ\}$   
range =  $\{y \in \mathbf{R} \mid -2 \leq y \leq 2\}$   
The horizontal axis has equation  $y = 0$ .

d)

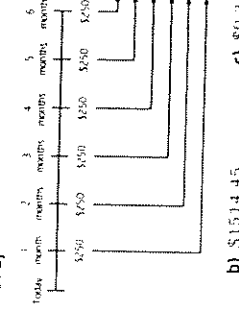


- period =  $360^\circ$   
amplitude = 1  
phase shift =  $30^\circ$  to the left  
domain =  $\{x \in \mathbf{R} \mid -30^\circ \leq x \leq 330^\circ\}$   
range =  $\{y \in \mathbf{R} \mid -1 \leq y \leq 1\}$   
The horizontal axis has equation  $y = 0$ .

## Chapters 6 to 8 Review, pages 418-419

1. a) 17 cm b) 21 cm  
2. a) 27 b) 40
- c)  $y = 3^x$ , where  $x$  is the number of the branch and  $y$  is the number of employees called at that branch.
- d) 7 e) 6
3. a) 2.1 billion  
b) Answers may vary. 1.7 billion
4. a)  $T(h) = 20(0.95)^h + 17$ , where  $T(h)$  is the body temperature and  $h$  is the time in hours.

- b)  $T(0) = 20(0.95)^0 + 17 = 37$
- c) Since  $20(0.95)^h$  is always positive, the lowest it can get is 0. So, the lowest the body temperature can get is  $0^\circ\text{C} + 17^\circ\text{C} = 17^\circ\text{C}$ .
- d) The witness is lying; if  $h = 3$ , then  $T(h) = 20(0.95)^3 + 17 = 34$ .
5. a) total interest = \$420;  
final amount = \$2420  
b) total interest = \$346.47;  
final amount = \$1296.47  
c) total interest = \$580.69;  
final amount = \$3280.69  
d) total interest = \$154.03;  
final amount = \$4654.03
6. a) \$1090.30 b) \$1314.17
7. a) option A since it has less interest to pay  
b) option B requires \$14.15 more interest
8. a) \$16 067.82 b) \$106.78
9. a)



- b) \$1514.45 c) \$0.31
10. \$1084.34
11. a) \$336 b) \$28 224 c) \$5224
12. a) \$327.92  
b) \$1275.53  
c) \$14 100.56; \$42 092.49  
d) 29.7 years
13. a) \$3700.85 b) \$298 204  
c) \$3893.73 d) \$4226.94