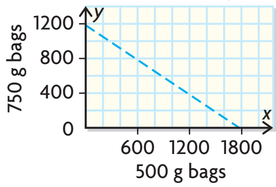
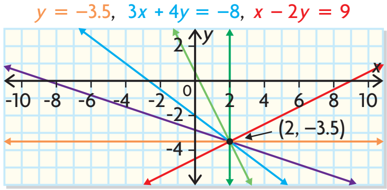
Chapter Self-Test, page 64

1. Let x represent the number of 500 g cartons, and let y represent the number of 750 g cartons; $0.5x + 0.75y = 887.5$

Possible Combinations of Raisin Bags



2. a) Let V represent the volume remaining, and let t represent the time after 8:30 a.m.; $V = 1500 - 4t$
   b) Answers may vary, e.g., about 10:30 a.m.
   c) 10:35 a.m.
3. a) $(-1.5, 2.5)$ b) $\left(\frac{-24}{7}, \frac{1}{7}\right)$ c) $(2, -3)$
4. about 13.33 g of 85% gold, about 6.67 g of 70% gold
5. Answers may vary, e.g., at the point (x, y), which represents a solution to a linear system, both sides of an equation in the system must be equal. Therefore, adding or subtracting these equations is the same as adding or subtracting constants to both sides of an equation: the solution will remain the same.
6. a) $4x + 2y = 1$, $2x + 6y = -17$; $x = 2$, $y = -3.5$
   b) $4x + 2y = 1$, $2x + 6y = -17$, $x = 2$, $y = -3.5$, $3x + 4y = -8$, $x - 2y = 9$



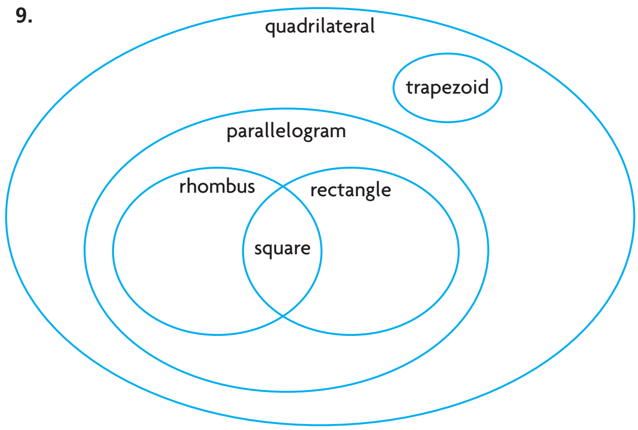
7. 6 km
8. $1500 in a savings account, $2700 in bonds
9. Answers may vary, e.g., adding the first equation to 3 times the second equation and then simplifying gives $15 = 24$, which is not true.

Chapter 2

Getting Started, page 68

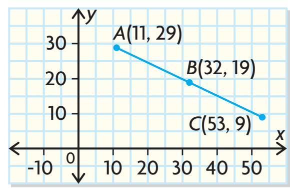
1. a) viii c) ii e) iv g) i
   b) vii d) v f) vi h) iii
2. a) 13 m
   b) about 192.3 mm
3. a) $y = \frac{1}{3}x + \frac{14}{3}$
   b) $y = -4x - 6$
   c) $y = -5x + 17$
4. a) $-\frac{3}{2}$ c) $\frac{35}{3}x$ e) $\frac{23}{20}$
   b) $-\frac{3}{56}$ d) $\frac{3}{8}y$ f) -1.4375

5. a) -2 c) 8 e) 3 or -3
   b) -1 d) 6 or -6 f) 8 or -8
6. a) $(1, 7)$ b) $\left(1, \frac{3}{2}\right)$
7. a) 6 b) $\frac{1}{4}$ c) 0.7
8. a) about 36.2 cm^2
   b) about 57.0 cm^2, about 41.7 cm
9.

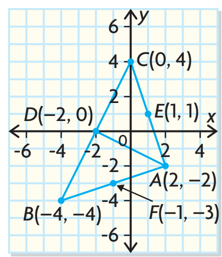


Lesson 2.1, page 78

1. a) $(3, 5)$ b) $(-0.5, 3.5)$
2. a) $(2, 3)$ b) $(0.5, 1)$ c) $(4, -2)$
3. a)



   b) $(32, 19)$
4. a) $(2, 5)$ c) $(2, -2)$ e) $(-1, -1)$
   b) $(0.5, 3.5)$ d) $(-0.5, 0.5)$ f) $(0.25, 0.75)$
5. $(0.75, -1)$
6. $(5, 3)$; from P to M, run $= 4$ and rise $= 2$; the run and rise will be the same from M to Q, so Q has coordinates $(1 + 4, 1 + 2)$
7. a), b) $y = -\frac{1}{2}x - 1$



8. Answers may vary, e.g., $(-4, 4)$ and $(2, 2)$ based on the assumption that the centre is at O, or $(5, 1)$ and $(-1, 3)$ based on the assumption that the centre is at R

9. yes

10. Answers may vary, e.g., in a rectangle, the diagonals bisect each other. This means that the midpoint of one diagonal is also the midpoint of the other diagonal. Mayda can determine the midpoint of the diagonal for which she knows the coordinates of both endpoints. Then she can use the coordinates of the midpoint and the coordinates of the known endpoint of the other diagonal to determine the missing coordinates.

11. **a)** $M_{PQ} = (2, 1)$, $M_{QR} = (1, -4)$, $M_{RP} = (6, 2)$
b) slope of $M_{PQ}M_{QR}$: 5; slope of $M_{QR}M_{RP}$: 1.2; slope of $M_{RP}M_{PQ}$: 0.25
c) slope of PQ: 1.2; slope of QR: 0.25; slope of RP: 5
d) Each midsegment is parallel to the side that is opposite it.

12. equation of median from K: $y = 8x - 11$;
equation of median from L: $y = -\frac{1}{4}x$;
equation of median from M: $y = \frac{7}{5}x - \frac{11}{5}$

13. **a)** $y = \frac{3}{2}x - \frac{7}{2}$
b) $y = \frac{4}{5}x - \frac{27}{5}$
c) $y = -\frac{5}{4}x + \frac{15}{4}$
d) $y = \frac{3}{4}x + \frac{7}{2}$

14. $y = \frac{5}{3}x - \frac{19}{3}$

15. (4, 3)

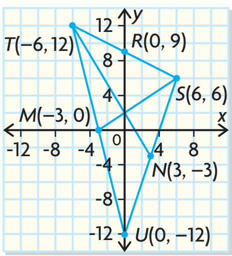
16. **a)** $y = 3x - 3$
b) All the perpendicular bisectors have the equation $y = 3x - 3$.
c) They are the same. All the perpendicular bisectors are the same as the line of reflection.

17. $(-2, -2)$

18. Answers may vary, e.g.,
i) Using the midpoint formula: $(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
ii) Using rise and run: Starting at one point, determine the rise and the run. Then add half the run to the x-coordinate of this point and add half the rise to the y-coordinate of this point.
These strategies are similar because they give the same answer. They are different because you are using the mean value of x and y in part i), but you are using the difference between x and y in part ii).

19. (4, 6); I added a third of the run from A to B to the x-coordinate of A, and I added a third of the rise from A to B to the y-coordinate of A.

20. **a)** (0, 2)
b) (0, 2) for both medians
c)

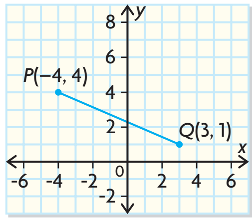


They intersect at (0, 2), which is two-thirds of the distance from each point to the midpoint of the opposite side.
d) Answers may vary, e.g., yes, because I tried it on several different triangles

Lesson 2.2, page 86

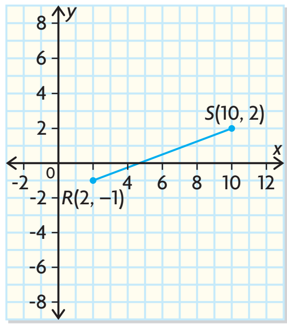
1. **a)** 5 units
b) 6 units
c) about 6.4 units
d) 10 units

2. **a) i)**



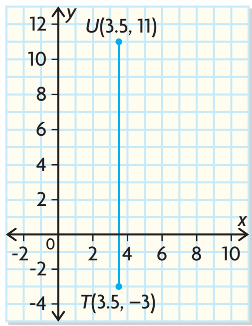
ii) about 7.6 units

b) i)



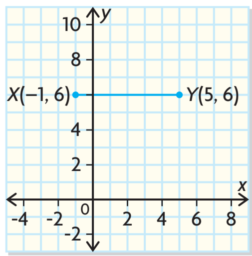
ii) about 8.5 units

c) i)



ii) 14 units

d) i)

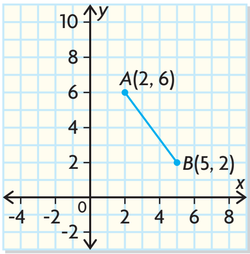


ii) 6 units

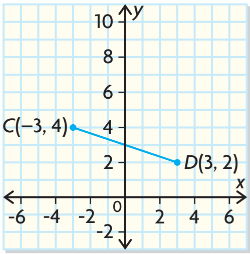
3. **a)** about 403 km
b) I assumed that the helicopter flew in a straight line.

4. **a)** 3 units
b) about 6.3 units
c) about 6.1 units
d) about 6.1 units
e) about 8.2 units
f) 8 units

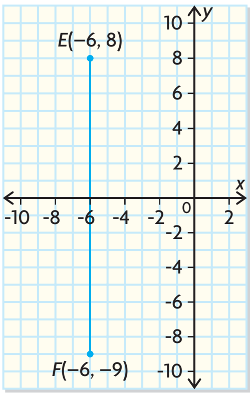
Answers

5\. a) i) 

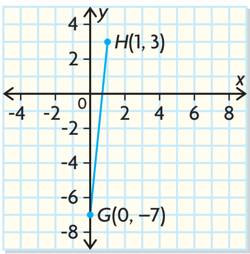
ii) 5 units

b) i) 

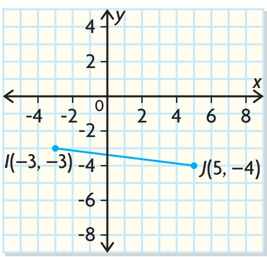
ii) about 6.3 units

c) i) 

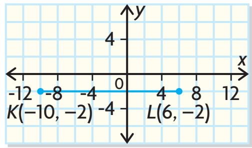
ii) 17 units

d) i) 

ii) about 10.0 units

e) i) 

ii) about 8.1 units

f) i) 

ii) 16 units

6\. a) The line segment in part f) is horizontal because the y-coordinates are the same. The line segment for part c) is vertical because the x-coordinates are the same.
b) For a horizontal line, the length is the positive difference between the x-coordinates. For a vertical line, the length is the positive difference between the y-coordinates.

7\. about 8.9 units

8\. D; B is about 11.1 units from A, C is about 5.1 units from A, and D is about 4.7 units from A.

9\. the fire hall in Bently

10\. Beast

11\. Answers may vary, e.g., they are the same because they both use the same information. They are different because the midpoint formula uses the mean values of the x-coordinates and y-coordinates, while the length formula uses the difference between the x-coordinates and the difference between the y-coordinates.

12\. a) about 4.1 units
b) about 5.7 units
c) about 7.2 units
d) about 1.7 units

13\. Highway 2: $\left(\frac{1}{5}, \frac{27}{5}\right)$; Highway 10: $\left(\frac{8}{5}, \frac{6}{5}\right)$

14\. about 96.6 m

15\. about 285.9 m

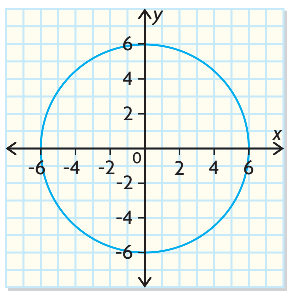
16\. Answers may vary, e.g., I would use the distance formula, $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$, to calculate the distance between each pair. For example, to determine whether $A(3, 4)$ or $B(-5, 2)$ is closer to $C(1, 1)$,
Distance $AC = \sqrt{(1 - 3)^2 + (1 - 4)^2} = \sqrt{13} \doteq 3.6$
Distance $BC = \sqrt{[1 - (-5)]^2 + (1 - 2)^2} = \sqrt{37} \doteq 6.1$

17\. a) $A' = (-3, 0)$, $B' = (0, 6)$, $C' = (4, 2)$
b) No. Answers may vary, e.g., because the length of AB is not equal to the length of DE

Lesson 2.3, page 91

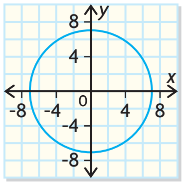
1\. a) (7, 0), (−7, 0)
b) (0, 7), (0, −7)
c) 7
d) $x^2 + y^2 = 49$

2\. a) $x^2 + y^2 = 9$
b) $x^2 + y^2 = 2500$
c) $x^2 + y^2 = \frac{49}{9}$
d) $x^2 + y^2 = 160\,000$
e) $x^2 + y^2 = 0.0625$

3\. a) i) 6 units ii) (6, 0), (−6, 0), (0, 6), (0, −6)
iii) 

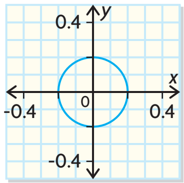
b) **i)** 7 units **ii)** $(7, 0), (-7, 0), (0, 7), (0, -7)$

iii)



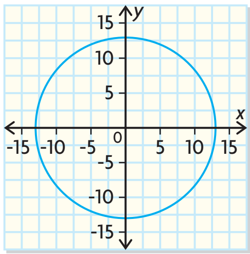
c) **i)** 0.2 units **ii)** $(0.2, 0), (-0.2, 0), (0, 0.2), (0, -0.2)$

iii)



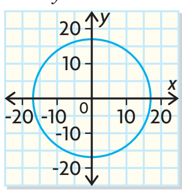
d) **i)** 13 units **ii)** $(13, 0), (-13, 0), (0, 13), (0, -13)$

iii)



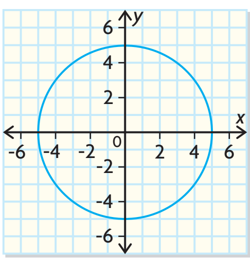
4. **a)** $x^2 + y^2 = 121$
b) $x^2 + y^2 = 81$
c) $x^2 + y^2 = 16$
d) $x^2 + y^2 = 36$

5. **a)** 17 units
b) $x^2 + y^2 = 289$
c)

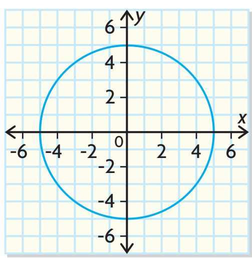


6. **a)** yes, $(-4)^2 + 7^2 = 65$
b) no, $5^2 + (-6)^2 \neq 65$
c) yes, $8^2 + (-1)^2 = 65$
d) no, $(-3)^2 + (-6)^2 \neq 65$

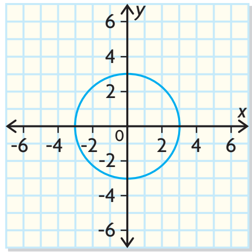
7. **a)** **i)** 5 units
ii) 5 units
iii) 3 units
iv) 17 units
b) **i)** $x^2 + y^2 = 25$
ii) $x^2 + y^2 = 25$
iii) $x^2 + y^2 = 9$
iv) $x^2 + y^2 = 289$
c) Answers may vary, e.g.,
i) $(3, 4), (-3, -4)$
ii) $(0, 5), (-5, 0)$
iii) $(3, 0), (-3, 0)$
iv) $(8, 15), (-8, -15)$
d) **i)**



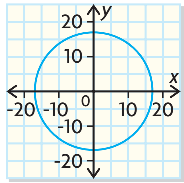
ii)



iii)



iv)



8. **a)** $x^2 + y^2 = 20\,736$
b) $x^2 + y^2 = 361\,000\,000$
c) $x^2 + y^2 = 1190.25$
d) $x^2 + y^2 = 1.44$

9. $x^2 + y^2 = 9$, $x^2 + y^2 = 20.25$, $x^2 + y^2 = 56.25$, $x^2 + y^2 = 81$, $x^2 + y^2 = 144$

10. about 1257 km

11. **a)** $x^2 + y^2 = 169$ **b)** $(-5, 12)$

12. $x^2 + y^2 = 289$

13. about 37s

14. $a = 10.0$ or -10.0, $b \doteq 6.6$ or -6.6

15. Answers may vary, e.g., I would calculate the distance from (0, 0) to (12 504, 16 050) and compare it with the square root of 45 000 000, which is the radius of the first satellite's orbit.

16. about 11.3 units by about 11.3 units

17. Answers may vary, e.g.,
Reason 1: The distance from the origin (0, 0) to the point (x, y) is $\sqrt{(x - 0)^2 + (y - 0)^2}$, which is equal to $\sqrt{x^2 + y^2}$. If, however, (x, y) is a point on a circle with centre (0, 0) and radius r, then the distance from (0, 0) to (x, y) is r. So $\sqrt{x^2 + y^2} = r$ and, if you square both sides, $x^2 + y^2 = r^2$.
Reason 2: The equation $x^2 + y^2 = r^2$ follows directly from the Pythagorean theorem applied to the right triangle with vertices at (0, 0), $(x, 0)$, and (x, y).
Reason 3: Using the formula $x^2 + y^2 = r^2$, I can see that the x- and y-intercepts are $(r, 0)$, $(-r, 0)$, $(0, r)$, $(0, -r)$. This makes sense for a circle, since all intercepts should be the same distance from the centre.

18. **a)** a circle centred at the origin, with a radius of $\frac{4}{3}$
b) a circle centred at $(2, -4)$, with a radius of 3

19. The most likely part of the load to hit the edge of the tunnel is the corner. The distance from the middle of the road to the corner of the load is $\sqrt{(4)^2 + (3.5)^2} \doteq 5.32$, or about 5.32 m. Since this is larger than the radius of the tunnel, the load will not fit through the tunnel.

Mid-Chapter Review, page 95

1. **a)** $(-4, 4)$ **b)** $(1.5, 4)$ **c)** $(0, 4)$ **d)** $(3, 2)$

2. $(6, -3)$

3. $y = -2x + 3$

4. all points on the equation $y = \frac{7}{2}x - \frac{39}{4}$

5. **a)** $M_{PQ} = (3, 3)$, $M_{QR} = (-5, 0)$, $M_{RP} = (4, 1)$
b) $y = -\frac{1}{10}x + \frac{7}{5}$
c) $y = -9x + 30$

6. **a)** about 5.4 units
b) about 12.1 units
c) 7 units
d) about 3.2 units

7. about 67.2 m

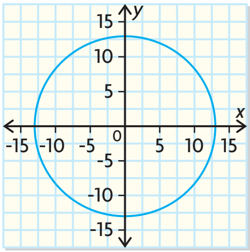
8. about 6.3 units

9. length $AB \doteq 5.8$ units, length $BC \doteq 8.2$ units, length $CA \doteq 8.6$ units; so the sides are unequal

10. **a) i)** $(0, 0)$

ii) radius: 13 units; x-intercepts: $(13, 0)$, $(-13, 0)$; y-intercepts: $(0, 13)$, $(0, -13)$

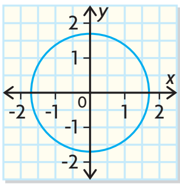
iii)



b) i) $(0, 0)$

ii) radius: 1.7 units;
x-intercepts: $(1.7, 0)$, $(-1.7, 0)$;
y-intercepts: $(0, 1.7)$, $(0, -1.7)$

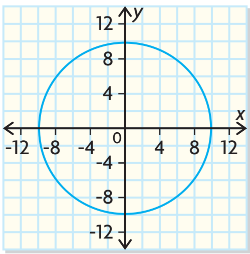
iii)



c) i) $(0, 0)$

ii) radius: about 9.9 units;
x-intercepts: about $(9.9, 0)$, about $(-9.9, 0)$;
y-intercepts: about $(0, 9.9)$, about $(0, -9.9)$

iii)



11. **a)** $x^2 + y^2 = 25$
b) $x^2 + y^2 = 49$
c) $x^2 + y^2 = 73$
d) $x^2 + y^2 = 97$

12. $x^2 + y^2 = 900$

13. **a)** on: $6^2 + (-3)^2 = 45$
b) outside: $(-1)^2 + 7^2 > 45$
c) inside: $(-3)^2 + 5^2 < 45$
d) outside: $(-7)^2 + (-2)^2 > 45$

14. **a)** $6^2 + (-7)^2 = 85$, $2^2 + 9^2 = 85$
b) $y = \frac{1}{4}x$
c) because $(0, 0)$ is the centre of the circle and because $0 = \frac{1}{4}(0)$, $(0, 0)$ also lies on the perpendicular bisector

Lesson 2.4, page 101

1. The slopes are equal: $m_{PQ} = m_{RS} = \frac{1}{4}$

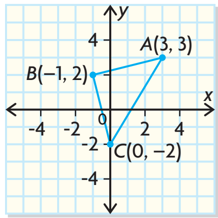
2. The slopes are negative reciprocals: $m_{TU} = -\frac{1}{m_{VW}} = -\frac{1}{2}$

3. $ABCD$ is a parallelogram. The lengths of the sides are needed to determine if it is also a rhombus.

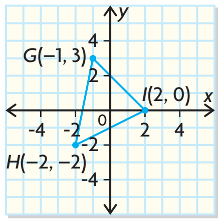
4. **a)** $DE = FD = \sqrt{65} \doteq 8.06$ units; $EF = \sqrt{130} \doteq 11.40$ units
b) $\sqrt{32.5} \doteq 5.72$ units
c) $m_{MD} = -\frac{1}{m_{EF}} = \frac{7}{9}$

5. $PQRS$ is a parallelogram and a rhombus. The slopes of the sides or the interior angles are needed to determine if it is also a square.

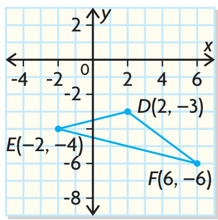
6. **a)** isosceles; $AB = \sqrt{17} \doteq 4.12$ units, $BC = \sqrt{17} \doteq 4.12$ units, $CA = \sqrt{34} \doteq 5.83$ units; two equal sides



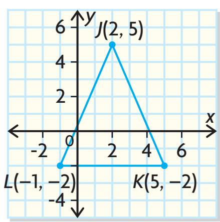
b) scalene; $GH = \sqrt{26} \doteq 5.10$ units, $HI = \sqrt{20} \doteq 4.47$ units, $GI = \sqrt{18} \doteq 4.24$ units; no equal sides



c) scalene; $DE = \sqrt{17} \doteq 4.12$ units, $EF = \sqrt{68} \doteq 8.25$ units, $DF = 5$ units; no equal sides



d) isosceles; $JK = \sqrt{58} \doteq 7.62$ units, $KL = 6$ units, $LJ = \sqrt{58} \doteq 7.62$ units; two equal sides



7. $m_{PQ} = -\frac{1}{m_{PR}} = -3$, so PQ is perpendicular to PR; that is, PQ meets PR at a right angle.

8. $m_{MN} = -\frac{1}{m_{NL}} = -\frac{4}{5}$; $MN = NL = \sqrt{41} \doteq 6.40$ units

9. a) Use the distance formula to determine the lengths of the three sides. If the lengths make the equation $a^2 + b^2 = c^2$ true, then the triangle is a right triangle.

b) i) $\triangle STU$ is a right triangle because $ST^2 + TU^2 = 17 + 68 = 85 = US^2$

ii) $\triangle XYZ$ is not a right triangle because $XY^2 = 20$, $YZ^2 = 80$, and $XZ^2 = 52$

iii) $\triangle ABC$ is a right triangle because $AB^2 + AC^2 = 13 + 13 = 26 = BC^2$

10. a) $WX = \sqrt{29} \doteq 5.39$ units, $XY = \sqrt{41} \doteq 6.40$ units, $YZ = \sqrt{29} \doteq 5.39$ units, $ZW = \sqrt{41} \doteq 6.40$ units; $m_{WX} = 0.4$, $m_{XY} = -1.25$, $m_{YZ} = 0.4$, $m_{ZW} = -1.25$

b) parallelogram; because opposite sides are equal length and parallel (since they have the same slope)

c) $\sqrt{90} - \sqrt{50} \doteq 2.42$ units

11. $m_{RS} = m_{TU} = \frac{2}{10}$, $m_{ST} = m_{UR} = \frac{4}{3}$ or $RS = TU = \sqrt{104} \doteq 10.20$, $ST = UR = 5$, so opposite sides are equal length and parallel (because they have the same slope).

12. $AB = BC = CD = DA = 5$, so all sides are equal.

13. a) $EF = FG = GH = HE = \sqrt{20} \doteq 4.47$, so all sides are equal; $m_{EF} = m_{GH} = -\frac{1}{2}$, $m_{FG} = m_{EH} = 2$, so adjacent sides meet at right angles.

b) $m_{EG} = -3$, $m_{HF} = \frac{1}{3}$; the slopes of EG and HF are negative reciprocals, so EG and HF are perpendicular to each other.

14. $m_{PQ} = -\frac{7}{9}$, $m_{QR} = \frac{3}{2}$; $m_{PQ} \neq -\frac{1}{m_{QR}}$; the slopes are not negative reciprocals, so the sides are not perpendicular; that is, they do not meet at right angles.

15. Answers may vary, e.g., I would use the distance formula to determine the lengths of all the sides. If they are equal, then the quadrilateral is a rhombus; e.g., $A(3, 0)$, $B(0, 2)$, $C(-3, 0)$, $D(0, -2)$. Or, I would use the slope formula to determine the slopes of all the sides. If the slopes of adjacent sides are negative reciprocals of each other, then the quadrilateral is a rectangle, e.g., $E(0, 0)$, $F(2, 1)$, $G(0, 5)$, $H(-2, 4)$. Or, if the quadrilateral is both a rhombus and a rectangle, then it is a square; e.g., $J(3, 0)$, $K(0, 4)$, $L(-4, 1)$, $M(-1, -3)$.

16. a) rhombus; $JK = KL = LM = JM = \sqrt{17} \doteq 4.12$ units; $m_{JK} = m_{LM} = \frac{1}{4}$, $m_{KL} = m_{JM} = 4$; all sides are equal length, but there are no right angles.

b) parallelogram; $EF = GH = 5$, $FG = EH = \sqrt{153} \doteq 12.37$ units; m_{FG} and m_{EH} are undefined (vertical), $m_{FG} = m_{EH} = \frac{1}{4}$, opposite sides are equal length and parallel, but there are no right angles.

c) parallelogram; $DE = FG = \sqrt{50} \doteq 7.07$ units, $EF = GH = \sqrt{29} \doteq 5.39$ units; $m_{DE} = m_{FG} = \frac{1}{7}$, $m_{EF} = m_{DG} = \frac{5}{2}$; opposite sides are equal length and parallel, but there are no right angles.

d) rectangle; $PQ = RS = \sqrt{68} \doteq 8.25$ units, $QR = PS = \sqrt{17} \doteq 4.12$ units; $m_{PQ} = m_{RS} = \frac{1}{4}$, $m_{QR} = m_{PS} = -4$; opposite sides are equal length and parallel, and angles between sides are 90°.

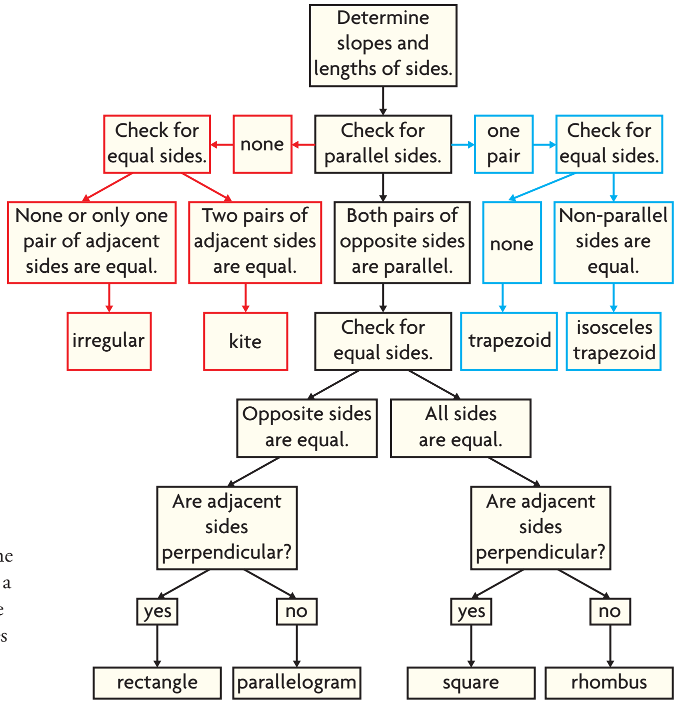
17. square; all side lengths are $\sqrt{106} \doteq 10.30$, or about 10.30 units, so the side lengths are equal; slopes are $\frac{5}{9}, -\frac{9}{5}, \frac{5}{9}, -\frac{9}{5}$, so the slopes of the sides are negative reciprocals.

18. a) $S(8, 2)$

b) Answers may vary, e.g., I determined the difference of the x- and y-coordinates between Q and P and then applied this difference to R.

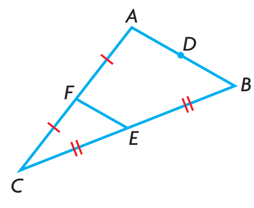
c) yes, $PR = QS = \sqrt{145} \doteq 12.04$, or about 12.04 units

19. Answers may vary, e.g.,



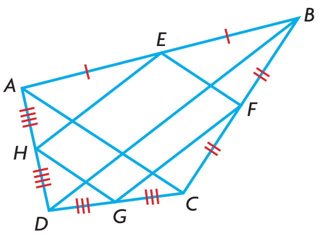
20. Answers may vary, e.g.,

a)



Since $\frac{AC}{FC} = \frac{BC}{EC}$ and $\angle ACB = \angle FCE$, $\triangle ABC$ is similar to $\triangle FEC$. Each side in the larger triangle is twice the length of the corresponding side in the smaller triangle.

b)



$\triangle AHE$ is similar to $\triangle ADB$, so $HE \parallel DB$.
$\triangle CGF$ is similar to $\triangle CDB$, so $GF \parallel DB$.
$\triangle DGH$ is similar to $\triangle DCA$, so $GH \parallel CA$.
$\triangle BFE$ is similar to $\triangle BCA$, so $FE \parallel CA$.
Since $HE \parallel DB \parallel GF$ and $GH \parallel CA \parallel FE$, $EFGH$ is a parallelogram.

Lesson 2.5, page 109

1. $AC = BD = \sqrt{65} \doteq 8.06$, so AC and BD are each about 8.06 units.

2. $m_{JL} = -\frac{1}{2}$, $m_{KM} = 2$; the slopes of the diagonals are negative reciprocals, so the diagonals are perpendicular.

3. Let S represent the midpoint of PR. Since $S = (1.5, 1.5)$, QS bisects PR. Since $m_{QS} = -\frac{1}{m_{PR}} = -7$, they are perpendicular.

4. $M_{JL} = M_{KM} = (-1, -3)$

5. $AC = BD = \sqrt{520} \doteq 22.80$ units

6. Answers may vary, e.g., conjecture: Quadrilateral $ABCD$ is a rectangle. I calculated the length and slope of each blue line segment and found that opposite sides are equal, and adjacent sides are perpendicular. My conjecture was correct.

7. Answers may vary, e.g., conjecture: Quadrilateral $JKLM$ is a kite. I calculated the length of each blue line segment and found that adjacent sides JK and KL are equal. Also adjacent sides JM and ML are equal. My conjecture was correct.

8. Let G represent the midpoint of EF; $G = (0, 3)$. Since $m_{EF} = -\frac{1}{m_{DG}} = 5$, DG is the median and the altitude.

9. Answers may vary, e.g., $M_{PQ} = (-1, 1)$, $M_{QR} = (3, 3.5)$, $M_{RS} = (7, 1)$, $M_{SP} = (3, -1.5)$; $M_{PQ}M_{QR} = M_{QR}M_{RS} = M_{RS}M_{SP} = M_{SP}M_{PQ} = \sqrt{22.25} \doteq 4.72$, or about 4.72 units; therefore, $M_{PQ}M_{QR}M_{RS}M_{SP}$ is a rhombus.

10. Answers may vary, e.g., $M_{RS} = (-3, 2.5)$, $M_{ST} = (-1.5, 1)$, $M_{TU} = (-4, -1.5)$, $M_{UR} = (-5.5, 0)$; diagonals $M_{RS}M_{TU} = M_{ST}M_{UR} = \sqrt{17} \doteq 4.12$, or about 4.12 units; therefore, the midpoints of the rhombus form a rectangle.

11. Answers may vary, e.g., $m_{RT} = -\frac{1}{m_{SU}} = -1$; the slopes of the diagonals are negative reciprocals, so the diagonals are perpendicular. $M_{RT} = M_{SU} = (-3.5, 0.5)$, so the diagonals bisect each other.

12. Answers may vary, e.g., $M_{AB} = (-4, -10)$, $M_{BC} = (-8, -2)$, $M_{CD} = (0, 2)$, $M_{DA} = (4, -6)$; $M_{AB}M_{BC} = M_{BC}M_{CD} = M_{CD}M_{DA} = M_{DA}M_{AB} = \sqrt{80} \doteq 8.94$ units, so the midsegments form a rhombus. $M_{AB}M_{CD} = M_{BC}M_{DA} = \sqrt{160} \doteq 12.65$, or about 12.65 units, so the rhombus is a rectangle and, therefore, a square.

13. **a)** $(-4)^2 + 3^2 = 25$, $3^2 + (-4)^2 = 25$
b) $m_{AB} = -1$; therefore, the equation of the perpendicular bisector of AB is $y = x$; for $y = x$, when $x = 0$ and $y = 0$, left side equals 0 and right side equals 0 so the centre $(0, 0)$ of the circle lies on the perpendicular bisector.

14. **a)** $M_{BC} = (-3, -0.5)$, $M_{AD} = (1.5, 1)$; slope of $M_{BC}M_{AD} = m_{AB} = m_{DC} = \frac{1}{3}$; the slopes are the same, so the line segments are parallel.
b) $M_{BC}M_{AD} = \sqrt{22.5} \doteq 4.74$, or about 4.74 units;
$\frac{BC + AD}{2} = \frac{\sqrt{10} + \sqrt{40}}{2} = 1.5\sqrt{10} = \sqrt{22.5} \doteq 4.74$,
or about 4.74 units

15. Answers may vary, e.g., area of $\triangle ABC = \frac{1}{2}(7)(4) = 14$, or 14 square units, area of $\triangle M_{AB}M_{BC}M_{AC} = \frac{1}{2}(3.5)(2) = 3.5 = \frac{1}{4}(14)$, or one-quarter of 14 square units

16. Answers may vary, e.g.,

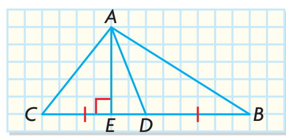
Determine the midpoint of the hypotenuse using the midpoint formula.
↓
Determine the distance from the midpoint to each vertex using the distance formula.
↓
Compare the distances.

17. Answers may vary, e.g., let the vertices of the square be $A(0, 0)$, $B(2a, 0)$, $C(2a, 2a)$, and $D(0, 2a)$. The midpoints of $M_{AB}M_{CD}$, $M_{BC}M_{AD}$, AC, and BD are all (a, a).

Lesson 2.6, page 113

1. (1, 4)

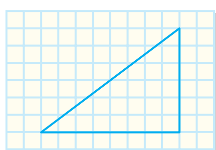
2. Answers may vary, e.g.,



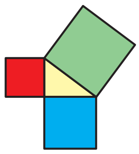
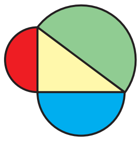
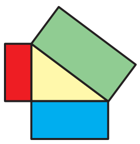
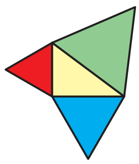
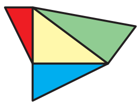
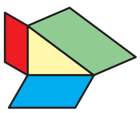
Let AD represent the median, and let AE represent the altitude. Both $\triangle ACD$ and $\triangle ABD$ have the same base (since $CD = DB$) and the same height, AE. Therefore, they have the same area.

3. **a)** $AE \times EB = CE \times ED = 60$
b) 1.25 m

4. **a)**



b) Answers may vary, e.g.,

Similar Figures	Diagram	A_1: Area on 6 cm Side (cm^2)	A_2: Area on 8 cm Side (cm^2)	$A_1 + A_2$ (cm^2)	Area on Hypotenuse (cm^2)
square		36	64	100	100
semicircle		14.14	25.13	39.27	39.27
rectangle		18	32	50	50
equilateral triangle		15.59	27.71	43.30	43.30
right triangle		9	16	25	25
parallelogram		18	32	50	50

c) no effect

d) The sum of the two smaller areas always equals the larger area.

Lesson 2.7, page 120

1. **a)** $\frac{1}{2}$ **b)** -2 **c)** $y = -2x + 2$

2. $y = \frac{1}{2}x - \frac{3}{2}$

3. $\left(\frac{7}{5}, -\frac{4}{5}\right)$

4. $BC = \sqrt{45} \doteq 6.71$, or about 6.71 units;
$AD = \sqrt{28.8} \doteq 5.37$, or about 5.37 units

5. 18 square units

6. **a)** $y = -\frac{5}{3}x - 3$

b) $y = -\frac{5}{3}x - 3$

c) $y = -\frac{5}{3}x - 3$

d) isosceles; the median and the altitude are the same.

7. **a)** $x^2 + y^2 = 85$

b) $7^2 + 6^2 = 85$

c) $m_{PR} = -\frac{1}{m_{RQ}} = \frac{1}{4}$, so the slopes are negative reciprocals; therefore, $\angle PRQ$ is a right angle.

8. about 27 square units

9. $\left(2, \frac{16}{3}\right)$

10. $\left(-\frac{16}{3}, 0\right)$

11. (2, 3)

12. (6, 4)

13. Answers may vary, e.g.,

i) Calculate DC, EC, and FC; check that they are equal.

ii) Construct the perpendicular bisectors for $\triangle DEF$; check that their intersection is at C.

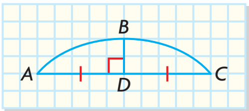
14. $\left(\frac{22}{3}, 8\right)$

15. 3:1

16. **a)** House A: about 37.2 m; house B: about 26.8 m; house C: about 34.8 m; assuming that the connection charge is proportional to distance, A has the highest charge.

b) about (18.1, 14.2)

17. right triangle; the lines forming two of the sides are perpendicular, having slopes -1 and 1.

18. 

Use the chord intersection rule to find E such that $AD \times DC = BD \times DE$; $BD + DE =$ diameter.

19. Answers may vary, e.g., to determine the median, I would calculate the midpoint of the opposite side and determine the slope of the segment between the vertex and the midpoint, which gives m. Then I would substitute one of these points into the equation of a line to determine b. To determine the altitude, I would calculate the slope of the opposite side and determine its negative reciprocal, which gives m. Then I would substitute the vertex into the equation of a line to determine b.

20. Let C represent the centroid;
$M_{PQ} = \left(\frac{3}{2}, -1\right)$, $M_{QR} = \left(\frac{5}{2}, -1\right)$, $M_{RP} = (0, 2)$, $C = \left(\frac{4}{3}, 0\right)$
$\frac{PC}{CM_{QR}} = \frac{QC}{CM_{RP}} = \frac{RC}{CM_{PQ}} = 2$

21. a) $(3a)^2 + a^2 = 10a^2$, $a^2 + (-3a)^2 = 10a^2$
b) Let C represent the centre; $C = (0, 0)$, $M_{RQ} = (2a, -a)$; slope $RQ = 2$, slope $CM_{RQ} = -\frac{1}{2}$; the slopes are negative reciprocals. Therefore, the line segments are perpendicular.

Chapter Review, page 124

1. (7.5, 28)
2. a) $y = x + 2$
b) yes, $m_{\text{median}} = -\frac{1}{m_{AC}} = 1$
3. $y = \frac{7}{4}x + \frac{21}{8}$
4. Q
5. about 89.5 units
6. about 21.8 units
7. 10 units
8. a) $x^2 + y^2 = 289$
b) x-intercepts: $(17, 0)$, $(-17, 0)$; y-intercepts: $(0, 17)$, $(0, -17)$; points: e.g., $(8, 15)$, $(8, -15)$, $(-8, -15)$
9. $x^2 + y^2 = 841$
10. $x^2 + y^2 = 16$
11. $(-2)^2 + k^2 = 20$
$k^2 = 16$
$k = 4$ or -4
12. $AB = BC = \sqrt{17} \doteq 4.12$, or about 4.12 units; two sides are equal in length, so the triangle is isosceles.
13. $AB = \sqrt{13} \doteq 3.61$, $BC = \sqrt{26} \doteq 5.10$, $CA = \sqrt{13} \doteq 3.61$, or about 3.61 units; two sides are equal in length, so the triangle is isosceles.
14. $JK = KL = LM = MJ = 5$ units; the sides are equal in length, so the quadrilateral is a rhombus.
15. $RS = TU = \sqrt{20} \doteq 4.47$, $ST = RU = \sqrt{17} \doteq 4.12$, or about 4.12 units
$m_{RS} = 2$, $m_{ST} = -\frac{1}{4}$, $m_{TU} = 2$, $m_{UR} = -\frac{1}{4}$
The opposite sides are equal and parallel, but the adjacent sides do not meet at 90°. Therefore, the quadrilateral is a parallelogram.
16. $M_{AB} = (-4, -4)$, $M_{BC} = (1, -5)$, $M_{CD} = (5, 1)$, $M_{DA} = (0, 2)$;
$M_{AB}M_{BC} = M_{CD}M_{DA} = \sqrt{26} \doteq 5.10$, or about 5.10 units;
$M_{BC}M_{CD} = M_{DA}M_{AB} = \sqrt{52} \doteq 7.21$, or about 7.21 units;
The slopes of the midsegments are $\frac{3}{2}$ and $-\frac{1}{5}$. The opposite sides are equal and parallel, but the adjacent sides do not meet at 90°. Therefore, the quadrilateral is a parallelogram.
17. $(10 - 5)^2 + (10 + 2)^2 = (-7 - 5)^2 + (3 + 2)^2 = (0 - 5)^2 + (-14 + 2)^2$
18. a) $m_{PQ} = -\frac{1}{m_{QR}} = \frac{5}{2}$; the slopes of PQ and QR are negative reciprocals, so PQ and QR form a right angle.
b) $M_{RP} = \left(2, \frac{5}{2}\right)$; $PM_{RP} = QM_{RP} = RM_{RP} = \sqrt{36.25} \doteq 6.02$, or about 6.02 units
19. a) $6^2 + 7^2 = (-9)^2 + 2^2$, so both points are the same distance from (0, 0).
b) Let A represent point (6, 7). Let B represent point (–9, 2). Let C represent the centre of the circle (0, 0). Let D represent the intersection of the line and the chord. $M_{AB} = \left(-\frac{3}{2}, \frac{9}{2}\right)$;
$m_{AB} = \frac{1}{3}$; $m_{CD} = -3$; therefore, the equation of the line through C is $y = -3x$. Since M_{AB} is on this line, $D = M_{AB}$.
20. a) $M_{JL} = M_{KM} = (5.5, -4.5)$
b) Answers may vary, e.g., conjecture: Quadrilateral $JKLM$ is a square.
c) Answers may vary, e.g., $JK = KL = LM = MJ = \sqrt{13} \doteq 3.61$, or about 3.61 units; I calculated to determine that opposite sides are equal and that adjacent sides are perpendicular. My conjecture was correct.
21. (0.5, 2)
22. (3, 2)
23. about (19.9, 89.3)
24. Answers may vary, e.g., it will be a parallelogram because the slopes of the lines form two pairs, which are not negative reciprocals;
$m_1 = -3$, $m_2 = \frac{4}{5}$, $m_3 = -3$, $m_4 = \frac{4}{5}$
25. a) $\left(\frac{453}{17}, \frac{194}{17}\right)$
b) about 6.79 m

Chapter Self-Test, page 126

1. a) about 40.3 m
b) $\left(4, \frac{11}{2}\right)$
2. a) $x^2 + y^2 = 1296$
b) 5 s

3. $AB = BC = 5$, or about 5 units, so two sides are equal; $m_{AB} = -\frac{1}{m_{BC}} = \frac{3}{4}$, so the slopes of two sides are negative reciprocals.

4. a) Answers may vary, e.g., $PR = QS = \sqrt{21\,125} \doteq 145.3$, or about 145.3 units
   b) 390 units

5. rhombus

6. about $(-4.6, -51.4)$

7. Answers may vary, e.g., to solve for the intercept, calculate the slope of a line through the first two points, and then substitute one of these points into the equation of a line. To determine the equation of the new line, substitute the third point into the equation of a line with a slope equal to the negative reciprocal of the first slope. To determine the point of intersection, set these two equations equal to each other. Calculate the distance between the point of intersection and the third point.

8. right isosceles

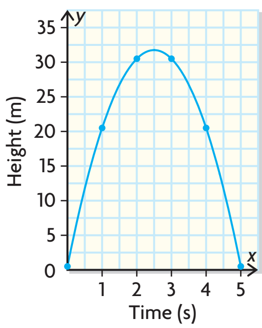
Chapter 3

Getting Started, page 130

1. a) v c) i e) vi
   b) ii d) iv f) iii

2. a) about 58 beats per minute
   b) about 38 years old

3. Answers may vary, e.g.,
   a) **Height of Baseball**



   b) about 32 m c) about 1.4 s and 3.6 s

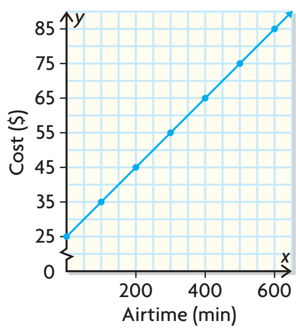
4. a) $4x + 12$ c) $-3x^3 + 6x^2$ e) $14x^4 + 25x^3 - 44x^2 + 2x$
   b) $2x^2 - 10x$ d) $-7x^2 + 9x$ f) $-10x^4 + 40x^3 - 6x^2$

5. a) 0 b) 9 c) 23 d) -5

6.

Airtime (min)	Cost ($)
0	25
100	35
200	45
300	55
400	65
500	75
600	85

Cost of Airtime

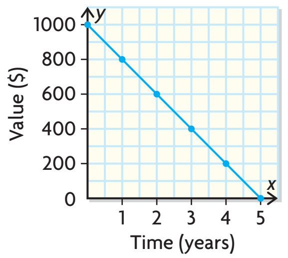


$C = 25 + 0.1t$

7.

Time (years)	Value ($)
0	1000
1	800
2	600
3	400
4	200
5	0

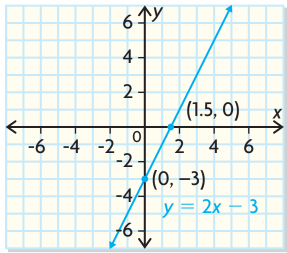
Value of Laptop vs. Time



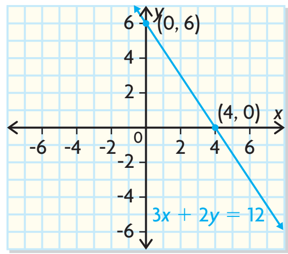
$V = 1000 - 200t$

8. x-intercept: $(-4, 0)$; y-intercept: $(0, -8)$

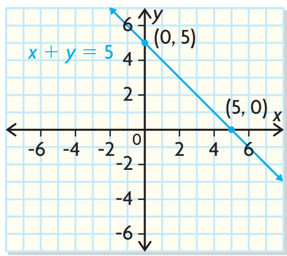
9. a) x-intercept: $(1.5, 0)$; y-intercept: $(0, -3)$



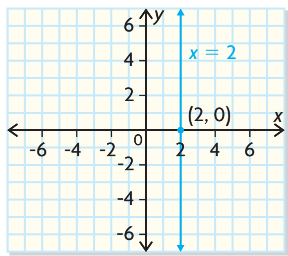
   d) x-intercept: $(4, 0)$; y-intercept: $(0, 6)$



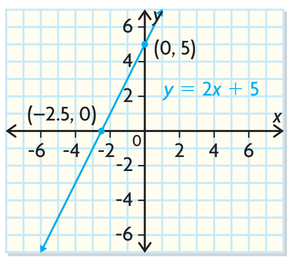
   b) x-intercept: $(5, 0)$; y-intercept: $(0, 5)$



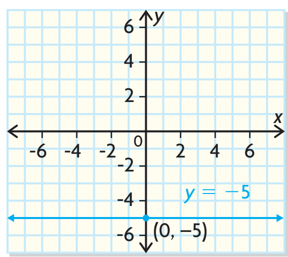
   e) x-intercept: $(2, 0)$; y-intercept: none



   c) x-intercept: $(-2.5, 0)$; y-intercept: $(0, 5)$



   f) x-intercept: none; y-intercept: $(0, -5)$



10. a) false, e.g., $y = x^2$

x	y	First Difference
1	1	
		3
2	4	
		5
3	9	
		7
4	16	

   b) false, e.g., $y = 2x$

x	y	First Difference
1	2	
		2
2	4	
		2
3	6	
		2
4	8	

Answers