Chapter 3 **Polynomials**

Chapter 3 Get Ready

Chapter 3 Get Ready **Question 1** **Page 102**

a) $7+5=12$

b) $10-3=7$

c) $5+(-9)=-4$

d) $5-(-4)=5+(+4)$
$=9$

e) $(-4)+6=2$

f) $7-9=7+(-9)$
$=-2$

g) $(-3)+(-11)=-14$

h) $(-4)-(-8)=-4+(+8)$
$=4$

Chapter 3 Get Ready **Question 2** **Page 102**

a) $(-2)+(-2)+1=-3$

b) $10-(-3)=10+(+3)$
$=13$

c) $5+(-7)+7=5$

d) $4+(-3)+(-2)=-1$

e) $(-9)-6=(-9)+(-6)$
$=-15$

f) $1-(-1)=1+(+1)$
$=2$

g) $(-5)-8=(-5)+(-8)$
$=-13$

h) $(-8)+9+(-2)=-1$

Chapter 3 Get Ready **Question 3** **Page 102**

a) $3\times(-8)=-24$

b) $(-4)\times(-6)=24$

c) $(-8)\times 4=-32$

d) $(-5)(-6)=30$

e) $12(-5)=-60$

f) $-2(20)=-40$

Chapter 3 Get Ready **Question 4** **Page 102**

a) $(-8) \div 4 = -2$

b) $9 \div (-3) = -3$

c) $\frac{-16}{8} = -2$

d) $\frac{-6}{-6} = 1$

e) $25 \div (-5) = -5$

f) $-36 \div (-4) = 9$

Chapter 3 Get Ready **Question 5** **Page 103**

a) $\frac{4}{5} \times \frac{1}{3} = \frac{4}{15}$

b) $-\frac{1}{3} \times \frac{1}{4} = -\frac{1}{12}$

c) $\frac{3}{5} \times \left(-\frac{2}{9}\right) = \frac{\overset{1}{\cancel{3}}}{5} \times \left(-\frac{2}{\underset{3}{\cancel{9}}}\right)$

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

d) $\left(-\frac{3}{4}\right) \times \left(-\frac{1}{5}\right) = \frac{3}{20}$

e) $-\frac{3}{8} \times \frac{4}{5} = -\frac{3}{\underset{2}{\cancel{8}}} \times \frac{\overset{1}{\cancel{4}}}{5}$

$= -\frac{3}{10}$

f) $\frac{1}{2}\left(-1\frac{1}{2}\right) = \frac{1}{2}\left(-\frac{3}{2}\right)$

$= -\frac{3}{4}$

Chapter 3 Get Ready **Question 6** **Page 103**

a) $\left(-\frac{2}{5}\right) \times \frac{1}{4} = -\frac{\overset{1}{\cancel{2}}}{5} \times \frac{1}{\underset{2}{\cancel{4}}}$

$= -\frac{1}{10}$

b) $\left(-\frac{3}{10}\right) \times \left(-\frac{5}{6}\right) = \frac{\overset{1}{\cancel{3}}}{\underset{2}{\cancel{10}}} \times \frac{\overset{1}{\cancel{5}}}{\underset{2}{\cancel{6}}}$

$= \frac{1}{4}$

c) $0.6 \times (-0.95) = -0.57$

d) $(-0.3)(-0.4) = 0.12$

e) $-2.5(3.2) = 8.0$

f) $8(-3.8) = -30.4$

Chapter 3 Section 1: Build Algebraic Models Using Concrete Materials

Chapter 3 Section 1 Question 1 Page 108

There are 4 x^2-tiles, 2 $-x$-tiles and 5 negative unit tiles. The expression represented is $4x^2 - 2x - 5$. Answer C.

Chapter 3 Section 1 Question 2 Page 108

a) $x^2 + 3x$

b) $2x^2 + 5$

c) $3x^2 + x + 2$

d) $x^2 + 2x + 4$

Chapter 3 Section 1 **Question 3 Page 108**

a) $x+3$

b) x^2+2

c) $2x^2+x+6$

d) x^2+4x+4

Chapter 3 Section 1 **Question 4 Page 108**

a) 4 km

b) 7 km

c) x km

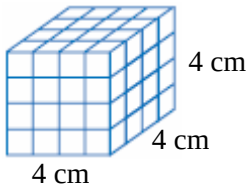
d) $4x$ km

Chapter 3 Section 1 **Question 5 Page 108**

Answers will vary.

Chapter 3 Section 1 **Question 6** **Page 108**

a)



b) The volume is $4^3 = 64$ cm^3.

c) $A = 4^2$
$= 16$

The area of one face is 16 cm^2.

Chapter 3 Section 1 **Question 7** **Page 109**

a) $s^3 = 216$
$s = 6$

A side length of 6 cm gives a volume of 216 cm^3.

b) $A = 6^2$
$= 36$

The area of one face is 36 cm^2.

Chapter 3 Section 1 **Question 8** **Page 109**

a) $49 = s^2$
$7 = s$

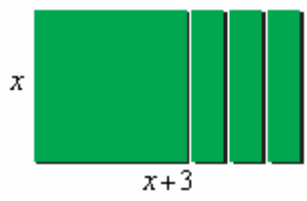
A side length of 7 m would give this area.

b) $V = 7^3$
$= 343$

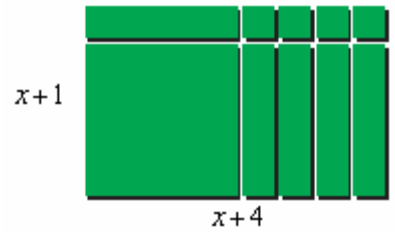
The volume of the cube is 343 m^3.

Chapter 3 Section 1 Question 9 Page 109

a)



b)



Chapter 3 Section 1 Question 10 Page 109

$$s^3 = 8$$
$$s = 2$$
$$SA = 6s^2$$
$$= 6 \times 2^2$$
$$= 24$$

The total surface area of all six faces is 24 cm^2.

Chapter 3 Section 1 Question 11 Page 109

Answers will vary. You can show that the conjecture works for the first few prime numbers.

$2^2 - 1 = 3$

$2^3 - 1 = 7$

$2^5 - 1 = 31$

$2^7 - 1 = 127$

$2^{11} - 1 = 2047$

Use your calculator to verify that each of these is a prime number. Tip: you only need to investigate divisors up to the square root of the number.

Chapter 3 Section 1 Question 12 Page 109

Start by using 1 for a and the largest number, 6, for b.

$1^6 + c^d + e^f$

Then, use your graphing calculator or spreadsheet to investigate all of the other combinations. A sample spreadsheet is shown. Click here to load the spreadsheet.

The smallest possible value of the expression if 90 when $a = 1$, $b = 6$, $c = 5$, $d = 2$, $e = 4$, and $f = 3$.

c	d	e	f	Expression
2	3	4	5	1033
2	3	5	4	634
2	4	3	5	260
2	4	5	3	142
2	5	3	4	114
2	5	4	3	97
3	2	4	5	1034
3	2	5	4	635
3	4	2	5	114
3	4	5	2	107
3	5	2	4	260
3	5	4	2	260
4	2	3	5	260
4	2	5	3	142
4	3	2	5	97
4	3	5	2	90
4	5	2	3	1033
4	5	3	2	1034
5	2	3	4	107
5	2	4	3	90
5	3	2	4	142
5	3	4	2	142
5	4	2	3	634
5	4	3	2	635
			Minimum	90

Chapter 3 Section 1 Question 13 Page 109

30^{40} will contribute 40 zeros to the product, and 40^{30} will contribute 30 zeros, for a total of 70 zeros. Answer C.

Chapter 3 Section 1 Question 14 Page 109

Answers will vary. You can show that the conjecture works for the first few prime numbers.

$2^{2^2}+1=17$

$2^{2^3}+1=257$

$2^{2^5}+1=4\,294\,967\,297$

Use your calculator to verify that the first two of these is a prime number. Tip: you only need to investigate divisors up to the square root of the number. Notice that the numbers become very large very quickly.

Chapter 3 Section 2 Work With Exponents

Chapter 3 Section 2 Question 1 Page 114

$6 \times 6 \times 6 \times 6 = 6^4$ Answer B.

Chapter 3 Section 2 Question 2 Page 114

$3^5 = 3 \times 3 \times 3 \times 3 \times 3$ Answer C.

Chapter 3 Section 2 Question 3 Page 114

a) $(-5) \times (-5) \times (-5) = (-5)^3$

b) $1.05 \times 1.05 \times 1.05 \times 1.05 \times 1.05 \times 1.05 = 1.05^6$

c) $\left(-\frac{3}{5}\right) \times \left(-\frac{3}{5}\right) \times \left(-\frac{3}{5}\right) = \left(-\frac{3}{5}\right)^3$

Chapter 3 Section 2 Question 4 Page 114

a) $(-4)^3 = (-4) \times (-4) \times (-4)$
$= -64$

b) $0.8^2 = 0.8 \times 0.8$
$= 0.64$

c) $\left(\frac{3}{4}\right)^4 = \left(\frac{3}{4}\right) \times \left(\frac{3}{4}\right) \times \left(\frac{3}{4}\right) \times \left(\frac{3}{4}\right)$
$= \frac{81}{256}$

Chapter 3 Section 2 Question 5 Page 114

a) $9^3 = 729$

b) $(-7)^2 = 49$

c) $-2^4 = -16$

d) $\left(\frac{5}{6}\right)^3 = \frac{125}{216}$

e) $\left(-\frac{2}{3}\right)^4 = \frac{16}{81}$

f) $1.2^2 = 1.44$

g) $1^8 = 1$

h) $(-1)^{55} = -1$

i) $0.5^3 = 0.125$

Chapter 3 Section 2 **Question 6 Page 114**

a) $2^5 \div 4^2 = \frac{32}{16}$
$= 2$

b) $5^3 - 5^2 = 125 - 25$
$= 100$

c) $1^3 + 1^6 - 1^2 = 1 + 1 - 1$
$= 1$

d) $\left(3^2 - 4^2\right) + \left(3^4 - 4^3\right) = (9 - 16) + (81 - 64)$
$= -7 + 17$
$= 10$

e) $\left(\frac{2}{3}\right)^3 \times \left(\frac{3}{4}\right)^2 = \frac{\cancel{8}^{1}}{\cancel{27}_{3}} \times \frac{\cancel{9}^{1}}{\cancel{16}_{2}}$
$= \frac{1}{6}$

f) $500(1.08)^5 \doteq 734.66$

Chapter 3 Section 2 **Question 7 Page 115**

a) $6s^2 = 6(5)^2$
$= 150$

b) $\pi r^2 = \pi(2.5)^2$
$\doteq 19.6$

c) $a^2 + b^2 = 3^2 + 4^2$
$= 9 + 16$
$= 25$

d) $\pi r^2 h = \pi(2.3)^2(5.2)$
$\doteq 86.4$

e) $\frac{4}{3}\pi r^3 = \frac{4}{3}\pi(1.5)^3$
$\doteq 14.1$

f) $x^2 - 2x - 24 = (-6)^2 - 2(-6) - 24$
$= 36 + 12 - 24$
$= 24$

Chapter 3 Section 2 **Question 8 Page 115**

a) $(-2)^2 = 4$

$(-2)^3 = -8$

$(-2)^4 = 16$

$(-2)^5 = -32$

b) When the exponent is odd, the power is negative, and when the exponent is even, the power is positive.

c) Negative bases will give a positive answer if the exponent is even and a negative answer if the exponent is odd.

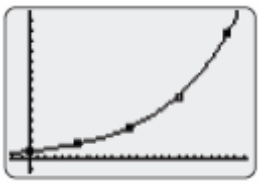
$$(-1)^2 = (-1)(-1)$$
$$= 1$$
$$(-1)^3 = (-1)(-1)(-1)$$
$$= -1$$

Chapter 3 Section 2 **Question 9 Page 115**

a)

Time (min)	Population of Listeria
0	800
60	1 600
120	3 200
180	6 400
240	12 800

b)



The graph is non-linear. It is increasing, as an upward curve.

c) After 1 day, or 24 h, the population will be 800×2^{24}.

After 2 days, or 48 h, the population will be 800×2^{48}.

d) Food poisoning will occur much faster if a large quantity of the bacteria is ingested rather than a smaller quantity because it will take the bacteria longer to multiply to a harmful amount. A faster growth rate of bacteria will cause the food poisoning to begin rapidly while a slower growth rate of bacteria will cause the food poisoning to start at a relatively slower rate.

Chapter 3 Section 2 **Question 10** **Page 116**

a)

Time (min)	Population of Listeria	Population of E. Coli
0	800	10
20		20
40		40
60	1600	80
80		160
100		320
120	3200	640

b) Continue the table:

Time (min)	Population of Listeria	Population of E. Coli
0	800	10
20		20
40		40
60	1600	80
80		160
100		320
120	3200	640
140		1280
160		2560
180	6400	5120
200		10240
220		20480
240	12800	40960

The population of E. coli will overtake the population of Listeria just after 180 min, or 3 h.

c) The population of each will be about 7000 when they are equal.

Chapter 3 Section 2 **Question 11 Page 116**

Note	Duration (in beats)	Power Form
whole	1	
half	$\frac{1}{2}$	$\left(\frac{1}{2}\right)^1$
quarter	$\frac{1}{4}$	$\left(\frac{1}{2}\right)^2$
eighth	$\frac{1}{8}$	$\left(\frac{1}{2}\right)^3$
sixteenth	$\frac{1}{16}$	$\left(\frac{1}{2}\right)^4$
thirty-second	$\frac{1}{32}$	$\left(\frac{1}{2}\right)^5$

Chapter 3 Section 2 **Question 12 Page 116**

$\left(\frac{1}{2}\right)^0 = 1$

This answer makes sense. The length of a whole note is 1. A calculator shows that any non-zero base raised to a power of 0 equals 1.

Chapter 3 Section 2 Question 13 Page 117

a) Let A represent the area of the rectangle.
Let w represent the width of the rectangle.
Let h represent the height of the rectangle.

$$\begin{aligned} A &= w \times h \\ &= w(2w) \\ &= 2w^2 \end{aligned}$$

b)
$$\begin{aligned} A &= 2w^2 \\ &= 2(8)^2 \\ &= 128 \end{aligned}$$

The area of a crest with a width of 8 cm is 128 cm^2.

c)
$$\begin{aligned} 72 &= 2w^2 \\ \frac{72}{2} &= \frac{2w^2}{2} \\ 36 &= w^2 \\ 6 &= w \\ h &= 2 \times 6 \\ &= 12 \end{aligned}$$

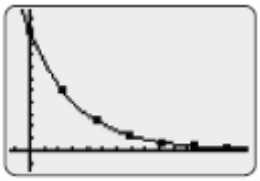
A crest with an area of 72 cm^2 has a height of 12 cm.

Chapter 3 Section 2 Question 14 Page 117

a)

Number of Half-Life Periods	Time (min)	Amount of U-238 Remaining (mg)	Expression
0	0	100	
1	23	50	$100\left(\frac{1}{2}\right)^1$
2	46	25	$100\left(\frac{1}{2}\right)^2$
3	69	12.5	$100\left(\frac{1}{2}\right)^3$
4	92	6.25	$100\left(\frac{1}{2}\right)^4$

b)



The graph is non-linear. It is decreasing, as a downward curve.

c) 2 h is $\frac{120}{23}$, or about 5.217 half-lives. The amount of U-239 remaining is about $100\left(\frac{1}{2}\right)^{5.217}$, or about 2.69 mg.

d) Use the "guess and check" method on your graphing calculator to determine that about 6.645 half-lives, or 152.8 min, are required for the sample to decay to 1 mg.

e) The original amount of U-239 is $100\left(\frac{1}{2}\right)^0$. This makes sense, since any non-zero base raised to the exponent 0 equals 1.

Chapter 3 Section 2 Question 15 Page 118

a) $4\,500\,000\,000 = 4.5 \times 10^9$

b) $4.5 \times 10^9 = 4.5 \times 10^9 \times 365 \times 24 \times 60 \times 60$

$\doteq 1.4 \times 10^{17}$

4.5×10^9 years is equivalent to about 1.4×10^{17} s.

c) $6.022 \times 10^{23} = 602\,200\,000\,000\,000\,000\,000\,000$

d) Answers will vary. A sample answer is shown.

Very large and very small numbers can be represented using a lot less space. It is also easier to understand scientific notation than trying to count the number of zeros in very large or very small numbers. It also reduces the probability of errors when rewriting these numbers.

Chapter 3 Section 2 Question 16 Page 118

a) Construct a table to organize your thinking. A sample table is shown.

Day	Returns	New Customers	Total
0		1	1
1	1	2	3
2	3	4	7
3	7	8	15
4	15	16	31
5	31	32	63
6	63	64	127
7	127	128	255
8	255	256	511
9	511	512	1023

After 2 days, there are 7 customers. After 5 days, there are 63 customers.

b) Barney's will reach 500 new customers on the ninth day.

c) After *n* days, the number of new customers is given by the expression $C = 2^n$.

d) Answers will vary. A sample answer is shown.

Assume that the trend continues without any change.

Chapter 3 Section 2 Question 17 Page 118

Calculate the powers of 3, as shown.

Exponent	Power
1	3
2	9
3	27
4	81
5	243
6	729
7	2187
8	6561
9	19683
10	59049
11	177147
12	531441
13	1594323
14	4782969
15	14348907
16	43046721

Note that the last digit follows the pattern 3, 9, 7, 1, repeating after every 4th power.

Note that $\frac{1234}{4} = 308.5$. There are 308 full cycles, plus 0.5 cycles.
The last digit in the expanded form will be 9.

Chapter 3 Section 2 Question 18 Page 118

Use the "guess and check" method on your calculator to determine that $3^6 = 729$. Answer C.

Chapter 3 Section 2 Question 19 Page 118

Start with powers of 2, then powers of 3, and so on until the powers exceed 1000. The perfect powers less than 1000 are:

4, 8, 16, 32, 64, 128, 256, 512, 9, 27, 81, 243, 729, 25, 125, 625, 36, 216, 49, 343, and 729.

Chapter 3 Section 2 **Question 20** **Page 118**

Investigate values of x and y using a spreadsheet to determine any patterns. Click here to load the spreadsheet.

x	y	x^y	y^x
1	0	1	0
1	1	1	1
2	0	1	0
2	1	2	1
2	2	4	4
2	3	8	9
2	4	16	16
2	5	32	25
2	6	64	36
2	7	128	49
3	0	1	0
3	1	3	1
3	2	9	8
3	3	27	27
3	4	81	64
3	5	243	125
3	6	729	216
4	0	1	0
4	1	4	1
4	2	16	16
4	3	64	81
4	4	256	256
4	5	1024	625
4	6	4096	1296
5	0	1	0
5	1	5	1
5	2	25	32
5	3	125	243
5	4	625	1024
5	5	3125	3125
5	6	15625	7776
5	7	78125	16807

$x = 1$	$y = 0$
$x = 2$	$y \leq 1$ or $y \geq 5$
$x = 3$	$y \leq 2$ or $y \geq 4$
$x \geq 4$	$y \leq 1$ or $y > x$

Chapter 3 Section 3 Discover the Exponent Laws

Chapter 3 Section 3 Question 1 Page 126

$7^3 \times 7^2 = 7^{3+2}$ Answer B.
$= 7^5$

Chapter 3 Section 3 Question 2 Page 126

a) $3^4 \times 3^7 = 3^{4+7}$
$= 3^{11}$
$= 177\,147$

b) $2^4 \times 2 \times 2^3 = 2^{4+1+3}$
$= 2^8$
$= 256$

c) $(-1)^5 \times (-1)^6 = (-1)^{5+6}$
$= (-1)^{11}$
$= -1$

d) $\left(\frac{2}{5}\right)^3 \times \left(\frac{2}{5}\right)^3 = \left(\frac{2}{5}\right)^{3+3}$
$= \left(\frac{2}{5}\right)^6$
$= \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5}$
$= \frac{64}{15\,625}$

Chapter 3 Section 3 Question 3 Page 127

$11^7 \div 11^5 = 11^{7-5}$ Answer D.
$= 11^2$

Chapter 3 Section 3 **Question 4** **Page 127**

a) $12^8 \div 12^2 = 12^{8-2}$
$= 12^6$
$= 2\,985\,984$

b) $(-6)^5 \div (-6)^2 \div (-6)^2 = (-6)^{5-2} \div (-6)^2$
$= (-6)^3 \div (-6)^2$
$= (-6)^{3-2}$
$= (-6)^1$
$= -6$

c) $\left(-\frac{3}{4}\right)^4 \div \left(-\frac{3}{4}\right) = \left(-\frac{3}{4}\right)^{4-1}$
$= \left(-\frac{3}{4}\right)^3$
$= \left(-\frac{3}{4}\right) \times \left(-\frac{3}{4}\right) \times \left(-\frac{3}{4}\right)$
$= -\frac{27}{64}$

d) $\frac{0.1^6 \div 0.1^4}{0.1^2} = \frac{0.1^{6-4}}{0.1^2}$
$= \frac{0.1^2}{0.1^2}$
$= 0.1^{2-2}$
$= 0.1^0$
$= 1$

Chapter 3 Section 3 **Question 5** **Page 127**

$\left(5^4\right)^2 = 5^{4\times 2}$ Answer A.
$= 5^8$

Chapter 3 Section 3 **Question 6** **Page 127**

a) $\left(4^2\right)^2 = 4^{2\times 2}$
$= 4^4$
$= 256$

b) $\left[(-3)^3\right]^2 = (-3)^{3\times 2}$
$= (-3)^6$
$= 729$

c) $\left[(-0.1)^4\right]^2 = (-0.1)^{4\times 2}$
$= (-0.1)^8$
$= 0.000\,000\,01$

d) $\left[\left(\frac{3}{2}\right)^3\right]^2 = \left(\frac{3}{2}\right)^{3\times 2}$
$= \left(\frac{3}{2}\right)^6$
$= \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2}$
$= \frac{729}{64}$

Chapter 3 Section 3 **Question 7 Page 127**

a) $5^2 \times 5^3 \div 5^4 = 5^{2+3} \div 5^4$
$= 5^5 \div 5^4$
$= 5^{5-4}$
$= 5^1$
$= 5$

b) $3^7 \div 3^5 \times 3 = 3^{7-5} \times 3$
$= 3^2 \times 3$
$= 3^{2+1}$
$= 3^3$
$= 27$

c) $\dfrac{\left(0.5^3\right)^4}{0.5^6 \times 0.5^4} = \dfrac{0.5^{3\times4}}{0.5^{6+4}}$
$= \dfrac{0.5^{12}}{0.5^{10}}$
$= 0.5^{12-10}$
$= 0.5^2$
$= 0.25$

d) $(-2)^4 \times (-2)^5 \div \left[(-2)^3\right]^3 = (-2)^{4+5} \div (-2)^{3\times3}$
$= (-2)^9 \div (-2)^9$
$= (-2)^{9-9}$
$= (-2)^0$
$= 1$

Chapter 3 Section 3 **Question 8 Page 127**

a) $y^4 \times y^2 = y^{4+2}$
$= y^6$

b) $m^8 \div m^5 = m^{8-5}$
$= m^3$

c) $k^2 \times k^3 \times k^5 = k^{2+3+5}$
$= k^{10}$

d) $\left(c^3\right)^4 = c^{3\times 4}$
$= c^{12}$

e) $a^2b^2 \times a^3b = a^{2+3}b^{2+1}$
$= a^5b^3$

f) $\left(2uv^2\right)^3 = 2^3u^3\left(v^2\right)^3$
$= 8u^3v^{2\times 3}$
$= 8u^3v^6$

g) $m^2n \times mn^2 = m^{2+1}n^{1+2}$
$= m^3n^3$

h) $h^2k^3 \div hk = h^{2-1}k^{3-1}$
$= hk^2$

i) $\left(-a^3b\right)^2 = (-1)^2\left(a^3\right)^2 b^2$
$= 1a^{3\times 2}b^2$
$= a^6b^2$

Chapter 3 Section 3 **Question 9 Page 127**

a) $12k^2m^8 \div 4km^5 = \frac{12}{4}k^{2-1}m^{8-5}$
$= 3km^3$

b) $-8a^5 \times \left(2a^3\right)^2 = -8 \times 2^2 \times a^5 \times \left(a^3\right)^2$
$= -32 \times a^5 \times a^{3\times 2}$
$= -32 \times a^5 \times a^6$
$= -32a^{5+6}$
$= -32a^{11}$

c) $\left(-x^2\right)^3 \times \left(3x^2\right)^2 = \left(-1\right)^3 \times 3^2 \times \left(x^2\right)^3 \times \left(x^2\right)^2$
$= -9 \times x^{2\times 3} \times x^{2\times 2}$
$= -9 \times x^6 \times x^4$
$= -9x^{6+4}$
$= -9x^{10}$

d) $\frac{4d^4w^3 \times 6dw^4}{3d^3w \times 8dw^2} = \frac{24d^{4+1}w^{3+4}}{24d^{3+1}w^{1+2}}$
$= \frac{24d^5w^7}{24d^4w^3}$
$= d^{5-4}w^{7-3}$
$= dw^4$

e) $\frac{3f^4g^3 \times 8fg^4}{\left(6f^2g^3\right)^2} = \frac{24f^{4+1}g^{3+4}}{6^2\left(f^2\right)^2\left(g^3\right)^2}$
$= \frac{24f^5g^7}{36f^{2\times 2}g^{3\times 2}}$
$= \frac{24f^5g^7}{36f^4g^6}$
$= \frac{2}{3}f^{5-4}g^{7-6}$
$= \frac{2}{3}fg$

f) $\left(3a^2b\right)^2 \div \left(ab\right)^2 = 3^2\left(a^2\right)^2b^2 \div a^2b^2$
$= 9a^{2\times 2}b^2 \div a^2b^2$
$= 9a^4b^2 \div a^2b^2$
$= 9a^{4-2}b^{2-2}$
$= 9a^2$

g) $\frac{5c^3d \times 4c^2d^2}{\left(2c^2d\right)^2} = \frac{20c^{3+2}d^{1+2}}{2^2\left(c^2\right)^2d^2}$
$= \frac{20c^5d^3}{4c^{2\times 2}d^2}$
$= \frac{20c^5d^3}{4c^4d^2}$
$= 5c^{5-4}d^{3-2}$
$= 5cd$

h)

$$\frac{\left(3xy^2\right)^3 \times \left(-4x^2y\right)}{\left(2x^2y^2\right)^2} = \frac{3^3 \times (-4) \times x^3 \times \left(y^2\right)^3 \times x^2 \times y}{2^2\left(x^2\right)^2\left(y^2\right)^2}$$

$$= \frac{-108 \times x^3 \times y^{2\times 3} \times x^2 \times y}{4x^{2\times 2}y^{2\times 2}}$$

$$= \frac{-108 \times x^3 \times y^6 \times x^2 \times y}{4x^4y^4}$$

$$= \frac{-108x^{3+2}y^{6+1}}{4x^4y^4}$$

$$= \frac{-108x^5y^7}{4x^4y^4}$$

$$= -27x^{5-4}y^{7-4}$$

$$= -27xy^3$$

i)

$$\frac{30g^2h \times (2gh)^2}{5gh^2 \times 6gh} = \frac{30 \times 2^2 \times g^2 \times h \times g^2 \times h^2}{30g^{1+1}h^{2+1}}$$

$$= \frac{120g^{2+2}h^{1+2}}{30g^2h^3}$$

$$= \frac{120g^4h^3}{30g^2h^3}$$

$$= 4g^{4-2}h^{3-3}$$

$$= 4g^2$$

Chapter 3 Section 3 **Question 10** **Page 128**

a)
$$\frac{5xy^2 \times 2x^2y}{(2xy)^2} = \frac{5(3)(-1)^2 \times 2(3)^2(-1)}{(2(3)(-1))^2}$$
$$= \frac{15 \times (-18)}{36}$$
$$= \frac{-270}{36}$$
$$= -\frac{15}{2}$$

b)
$$\frac{5xy^2 \times 2x^2y}{(2xy)^2} = \frac{10x^{1+2}y^{2+1}}{2^2x^2y^2}$$
$$= \frac{10x^3y^3}{4x^2y^2}$$
$$= \frac{5}{2}x^{3-2}y^{3-2}$$
$$= \frac{5}{2}xy$$

$$\frac{5}{2}xy = \frac{5}{2}(3)(-1)$$
$$= -\frac{15}{2}$$

c) Answers will vary. A sample answer is shown.

Substituting values into a simplified expression is much easier than substituting into the original expression. The disadvantage is that it is easy to make a mistake when simplifying the expression.

Chapter 3 Section 3 **Question 11** **Page 128**

$$V = 1 \times 10 \times 1000$$
$$= 10\,000$$

The volume of the crawl space is 10 000 m^3.

Chapter 3 Section 3 Question 12 Page 128

a) $\left(\frac{1}{2}\right)^6 = \frac{1}{64}$

$\left(\frac{1}{2}\right)^{12} = \frac{1}{4096}$

The probability of tossing 6 heads in a row is $\frac{1}{64}$. The probability of tossing 12 heads in a row is $\frac{1}{4096}$.

b) $\left(\frac{1}{2}\right)^6 = \left(\left(\frac{1}{2}\right)^2\right)^3$

$\left(\frac{1}{2}\right)^{12} = \left(\left(\frac{1}{2}\right)^2\right)^6$

Chapter 3 Section 3 Question 13 Page 128

a) The probability of rolling a 6 with a standard number cube is $\frac{1}{6}$.

b) The probability of rolling four 6s in a row is $\left(\frac{1}{6}\right)^4$, or $\frac{1}{1296}$.

c) The perfect squares on a number cube are 1 and 4. The probability of rolling a perfect square with a number cube is $\frac{2}{6}$, or $\frac{1}{3}$.

d) The probability of rolling eight perfect squares in a row is $\left(\frac{1}{3}\right)^8$, or $\frac{1}{6561}$.

e) $\left(\frac{1}{6}\right)^4 = \left(\left(\frac{1}{6}\right)^2\right)^2$

$\left(\frac{1}{3}\right)^8 = \left(\left(\frac{1}{3}\right)^4\right)^2$

Chapter 3 Section 3 Question 14 Page 128

Solutions for the Achievement Checks are shown in the Teacher's Resource.

Chapter 3 Section 3 Question 15 Page 129

a) $4\times10^2\times2\times10^3=8\times10^5$
$=800\,000$

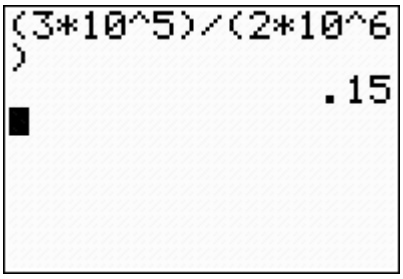
b) $1.5\times10^4\times6\times10^6=9\times10^{10}$
$=90\,000\,000\,000$

c) $\left(8\times10^7\right)\div\left(2\times10^5\right)=4\times10^2$
$=400$

d) $\left(3.9\times10^{12}\right)\div\left(3\times10^8\right)=1.3\times10^4$
$=13\,000$

Chapter 3 Section 3 Question 16 Page 129

a) Answers will vary. A possible prediction is 0.15.

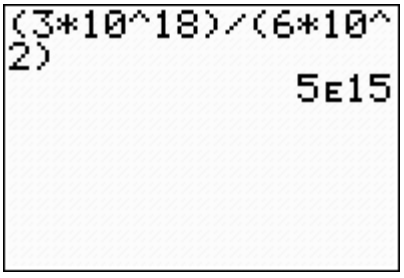


b) The prediction was correct.

$\left(3\times10^5\right)\div\left(2\times10^6\right)=\left(3\times10^5\right)\div\left(20\times10^5\right)$
$=\frac{3}{20}$
$=0.15$

Chapter 3 Section 3 Question 17 Page 129

a) Answers will vary. A possible prediction is 0.5×10^{16}.



b) $\left(3\times10^{18}\right)\div\left(6\times10^2\right)=\left(30\times10^{17}\right)\div\left(6\times10^2\right)$
$=5\times10^{15}$

Note that the calculator uses an E rather than a 10 for Scientific Notation.

Chapter 3 Section 3 Question 18 Page 129

a) $\left(2\times10^5\right)^3=8\times10^{15}$
$=8\,000\,000\,000\,000\,000$

b) Answers will vary. A sample answer is shown.

You must apply the power to both the number and the power of 10, using the exponent rules.

$\left(3\times10^4\right)^2=9\times10^8$

Chapter 3 Section 3 **Question 19** **Page 129**

The exponents of a must add to 39, and the exponents of b must add to 30.

$a^{19}b^{16}$	$a^{5}b^{2}$	$a^{15}b^{12}$
$a^{9}b^{6}$	$a^{13}b^{10}$	$a^{17}b^{14}$
$a^{11}b^{8}$	$a^{21}b^{18}$	$a^{7}b^{4}$

Chapter 3 Section 3 **Question 20** **Page 129**

$$x = \frac{1}{9}$$

$$x^2 = \frac{1}{81}$$

$$x^3 = \frac{1}{729}$$

$$\sqrt{x} = \frac{1}{3}$$

$$\frac{1}{x} = 9$$

From least to greatest, the values are $x^3, x^2, x, \sqrt{x}$, and $\frac{1}{x}$.

Chapter 3 Section 4 Communicate With Algebra

Chapter 3 Section 4 Question 1 Page 134

a) The coefficient is 2, and the variable is y.

b) The coefficient is –3, and the variable is x.

c) The coefficient is 1, and the variable is mn.

d) The coefficient is $\frac{1}{2}$, and the variable is x^2.

e) The coefficient is –1, and the variable is w^2.

f) The coefficient is –0.4, and the variable is gh^3.

Chapter 3 Section 4 Question 2 Page 134

There are 3 terms in $7x^2 + 3xy + 4y^2$. It is a trinomial. Answer C.

Chapter 3 Section 4 Question 3 Page 134

a) There is one term. $-2x$ is a monomial.

b) There are 3 terms. $6y^2 - 2y - 1$ is a trinomial.

c) There are 2 terms. $a - \frac{1}{2}b$ is a binomial.

d) There are 3 terms. $3u^2 - uv + 2v^2$ is a trinomial.

e) There are 2 terms. $3k^2 - \frac{1}{2}k$ is a binomial.

f) There are 4 terms. $m + 0.2n - 0.3 + mn$ is a four-term polynomial.

Chapter 3 Section 4 Question 4 Page 134

The highest exponent is 2. The degree of the expression is 2. Answer B.

Chapter 3 Section 4 Question 5 Page 134

a) The degree of the term is 2.

b) The degree of the term is 1.

c) The degree of the term is 0.

d) The degree of the term is 6.

e) The degree of the term is 5.

f) The degree of the term is 3.

Chapter 3 Section 4 Question 6 Page 135

a) The degree of the polynomial is 1.

b) The degree of the polynomial is 2.

c) The degree of the polynomial is 3.

d) The degree of the polynomial is 7.

e) The degree of the polynomial is 6.

Chapter 3 Section 4 Question 7 Page 135

A contestant's total points is represented by the expression $500c - 200i$. Answer B.

Chapter 3 Section 4 Question 8 Page 135

a) The total points is described by $2w + t$. Answer D.

b) Answer C is technically correct, but is considered improper form. C shows a coefficient of 1 and D does not, but $1t = t$.

Chapter 3 Section 4 Question 9 Page 135

a) $3x+5=3\times 2+5$
$=6+5$
$=11$

b) $4y+4=4(-2)+4$
$-8+4$
$=-4$

c) $a^2+2b-7=4^2+2\times 1-7$
$=16+2-7$
$=11$

d) $2m^2-3n+8=2(-2)^2-3\times 5+8$
$=8-15+8$
$=1$

Chapter 3 Section 4 Question 10 Page 135

a) Answers will vary. A possible variable is s.

b) $0.37s$

c) $0.37s=0.37(25.99)$
$\doteq 9.62$

The school receives \$9.62.

d) $0.37s=0.37(4257.49)$
$\doteq 1575.27$

The school will receive \$1575.27 for this fund raiser.

Chapter 3 Section 4 **Question 11** **Page 136**

a) $5s + 7a$

b)

Term	Variable	Coefficient	Meaning
$5s$	s	5	s: number of student memberships she sells
$7a$	a	7	a: number of adult memberships she sells

c) $5s + 7a = 5 \times 12 + 7 \times 10$
$= 60 + 70$
$= 130$

Meredith will receive a bonus of \$130.

Chapter 3 Section 4 **Question 12** **Page 136**

a) $25g + 18r + 15b$

b)

Term	Variable	Coefficient	Meaning
$25g$	g	25	g: number of gold seats sold
$18r$	r	18	r: number of red seats sold
$15b$	b	15	b: number of blue seats sold

c) $25g + 18r + 15b = 25 \times 100 + 18 \times 250 + 15 \times 200$
$= 2500 + 4500 + 3000$
$= 10\,000$

The area will earn \$10 000.

Chapter 3 Section 4 **Question 13** **Page 136**

a) $2c - w$

b) $2c - w = 2 \times 15 - 3$
$= 30 - 3$
$= 27$

Chapter 3 Section 4 **Question 14** **Page 136**

Answers will vary.

Chapter 3 Section 4 **Question 15** **Page 136**

Answers will vary. A sample answer is shown.

Hello Manuel,
A term is made up of a coefficient (a number) and a variable (e.g., a, x, j), but there are no mathematical operations (addition, subtraction) involved. A polynomial is a set of terms being added or subtracted (e.g., $7x + 5y$).
Jill

Chapter 3 Section 4 **Question 16** **Page 137**

a) $\text{height} = 2w$

b) $\text{height} = 2 \times 5$
$= 10$

A crest that is 5 cm wide will be 10 cm high.

c) $25 = 2w$
$\frac{25}{2} = \frac{2w}{2}$
$12.5 = w$

A crest that is 25 cm high will be 12.5 cm wide.

Chapter 3 Section 4 **Question 17** **Page 137**

Solutions for the Achievement Checks are shown in the Teacher's Resource.

Chapter 3 Section 4 **Question 18 Page 137**

a) Answers will vary. Choose s for the swim, c for the cycle, and r for the run.

b)

Part of the Race	Speed (km/h)	Distance (km)	Time (h)
Swim	1.2	s	$\frac{s}{1.2}$
Cycle	25	c	$\frac{c}{25}$
Run	10	r	$\frac{r}{10}$

c) The total time is modelled by the trinomial $\frac{s}{1.2}+\frac{c}{25}+\frac{r}{10}$.

d)
$$\begin{aligned}\frac{s}{1.2}+\frac{c}{25}+\frac{r}{10} &= \frac{1.5}{1.2}+\frac{40}{25}+\frac{10}{10}\\ &= 1.25+1.6+1\\ &= 3.85\end{aligned}$$

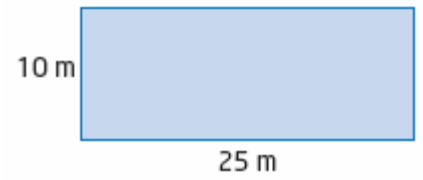
Alberto's total time will be 3.85 h.

e) Answers will vary. A sample answer is shown.

It is a reasonable time considering all the things he has to complete in only 3.85 h.

Chapter 3 Section 4 **Question 19** **Page 138**

a) Answers will vary. A possible prediction is that it is faster to walk.



b) $t = \frac{w}{2}$

$= \frac{35}{2}$

$= 17.5$

Ashleigh will take 17.5 s to walk around the border.

c) Let the diagonal distance that Ashleigh must swim be represented by s.

$s^2 = 10^2 + 25^2$

$s^2 = 100 + 625$

$s^2 = 725$

$\sqrt{s^2} = \sqrt{725}$

$s \doteq 26.9$

$t = \frac{s}{1}$

$= \frac{26.9}{1}$

$= 26.9$

Ashleigh will take 26.9 s to swim the diagonal.

d) It is faster to walk by 26.9 – 17.5, or 9.4 s.

Chapter 3 Section 4 **Question 20 Page 138**

a) Answers will vary. One possible prediction is that it will be faster to walk half the length, and then swim.

$$\begin{aligned} s^2 &= 10^2 + 12.5^2 \\ s^2 &= 100 + 156.25 \\ s^2 &= 256.25 \\ \sqrt{s^2} &= \sqrt{256.25} \\ s &\doteq 16 \end{aligned}$$

b)

$$\begin{aligned} t &= \frac{s}{1} + \frac{w}{2} \\ &= \frac{16}{1} + \frac{12.5}{2} \\ &= 16 + 6.25 \\ &= 22.25 \end{aligned}$$

The time taken for Path #3 is 22.25 s. It is fastest to walk all of the way.

c) Walking all the way takes 17.5 s and it is the fastest way. Find the time for all three ways and compare the times.

Chapter 3 Section 4 **Question 21** **Page 139**

a) Let an x-tile represent $0.1v$, and show one of them.

b) Let a y-tile represent $100s$, and show three of them.

c) Let a unit tile represent \$100. The model is shown.

d) $C = 500 + 0.1(500\,000) + 300(50)$
$= 65\,500$

It costs \$65 500 to insure a 50-seat plane valued at \$500 000.

Chapter 3 Section 4 **Question 22** **Page 139**

$3m + 5 = 23$
$3m = 23 - 5$
$3m = 18$

$2n - 7 = 21$
$2n = 21 + 7$
$2n = 28$

$3m + 2n = 18 + 28$
$= 46$

Answer C.

Chapter 3 Section 4 **Question 23** **Page 139**

Since the value of the expression is even, one of the prime numbers must be 2. Let $a = 2$.

Divide by 2 repeatedly to show that $18\,144 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 567$.

Divide 567 repeatedly by 3 to show that $567 = 3 \times 3 \times 3 \times 3 \times 7$.

You may conclude that $x + y + z = 5 + 4 + 1$, or 10.

Answer B.

Chapter 3 Section 4 **Question 24 Page 139**

$$\left(\frac{1}{4}\right)^m = \left(\left(\frac{1}{2}\right)^2\right)^m$$
$$= \left(\frac{1}{2}\right)^{2m}$$

This expression is true for all values of m.

Chapter 3 Section 5 Collect Like Terms

Chapter 3 Section 5 Question 1 Page 151

$3x^2 + 3xy + 3$ contains no like terms. Answer B.

Chapter 3 Section 5 Question 2 Page 151

a) $2x$ and $-5x$ are like terms.

b) $3y$ and $3z$ are unlike terms.

c) $-x^2$ and $\frac{1}{2}x^2$ are like terms.

d) $4a^2$ and $3a^3$ are unlike terms.

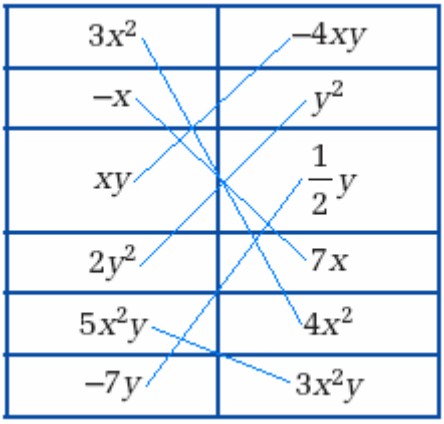
e) $2ab$ and $3a^2$ are unlike terms.

f) $5x^2y$ and $-2xy^2$ are unlike terms.

g) $3uv$ and $2vu$ are like terms.

h) $9p^2q^3$ and $-4q^3p^2$ are like terms.

Chapter 3 Section 5 Question 3 Page 151



Chapter 3 Section 5 Question 4 Page 151

Answers will vary. Sample answers are shown.

a) $3m$, $9m$

b) $4x$, $-6x$

c) $9y^2$, $7y^2$

d) $-ab$, $2ab$

Chapter 3 Section 5 Question 5 Page 151

a) $3x + 6x = 9x$

b) These are not like terms. The expression cannot be simplified.

c) $5h + 8h + 2h = 15h$

d) $7u + 4u + u = 12u$

Chapter 3 Section 5 **Question 6** **Page 151**

a) $4k - 2k = 2k$

b) $8n - n = 7n$

c) $3z - 7z = -4z$

d) These are not like terms. The expression cannot be simplified.

Chapter 3 Section 5 **Question 7** **Page 151**

a)
$$\begin{aligned} 3x + 5 + 2x + 1 &= 3x + 2x + 5 + 1 \\ &= 5x + 6 \end{aligned}$$

b)
$$\begin{aligned} 3 + 7y + 8 + y &= 3 + 8 + 7y + y \\ &= 11 + 8y \end{aligned}$$

c)
$$\begin{aligned} 2k + 3m + 4m + 6k &= 2k + 6k + 3m + 4m \\ &= 8k + 7m \end{aligned}$$

d)
$$\begin{aligned} 7u + v + v + u &= 7u + u + v + v \\ &= 8u + 2v \end{aligned}$$

e)
$$\begin{aligned} 8n + 5 - 3n - 2 &= 8n - 3n + 5 - 2 \\ &= 5n + 3 \end{aligned}$$

f)
$$\begin{aligned} 4p + 7q - 3q - p &= 4p - p + 7q - 3q \\ &= 3p + 4q \end{aligned}$$

Chapter 3 Section 5 **Question 8** **Page 152**

a)
$$\begin{aligned} 3x - 8 - 4x + 3 &= 3x - 4x - 8 + 3 \\ &= -x - 5 \end{aligned}$$

b)
$$\begin{aligned} y - 9 - 7 - 6y &= y - 6y - 9 - 7 \\ &= -5y - 16 \end{aligned}$$

c)
$$\begin{aligned} 2x^2 + 7x + 4x^2 + x &= 2x^2 + 4x^2 + 7x + x \\ &= 6x^2 + 8x \end{aligned}$$

d)
$$\begin{aligned} 7m + 6m^2 - 2m + m^2 &= 6m^2 + m^2 + 7m - 2m \\ &= 7m^2 + 5m \end{aligned}$$

e)
$$\begin{aligned} 3k - 5 + 8 - k + 1 - 4k &= 3k - k - 4k + 1 - 5 + 8 \\ &= -2k + 4 \end{aligned}$$

f)
$$\begin{aligned} -3u + 2 - u^2 - 5 + 3u + 2u^2 - 3 &= -u^2 + 2u^2 - 3u + 3u + 2 - 5 - 3 \\ &= u^2 - 6 \end{aligned}$$

Chapter 3 Section 5 **Question 9** **Page 152**

a)
$$\begin{aligned} 2a^2 - 3ab - 6 + 4b^2 + 7 + 5ab - 3b - 2a^2 &= 2a^2 - 2a^2 - 3ab + 5ab - 3b + 4b^2 - 6 + 7 \\ &= 2ab - 3b + 4b^2 + 1 \end{aligned}$$

b)
$$\begin{aligned} 3mn + 6m^2 - n^2 + 3 - m^2 - 3mn + 2n^2 - 4 &= 3mn - 3mn + 6m^2 - m^2 - n^2 + 2n^2 + 3 - 4 \\ &= 5m^2 + n^2 - 1 \end{aligned}$$

Chapter 3 Section 5 **Question 10 Page 152**

a) Claudette: $7t + 100$
Johanna: $7t + 125$
Ming: $7t + 110$

Employee	Number of Hours	Bonus
Claudette	20	$100
Johanna	25	$125
Ming	27	$110

b)

Claudette:

$$\begin{aligned} 7t + 100 &= 7 \times 20 + 100 \\ &= 140 + 100 \\ &= 240 \end{aligned}$$

Claudette makes $240.

Johanna:

$$\begin{aligned} 7t + 125 &= 7 \times 25 + 125 \\ &= 175 + 125 \\ &= 300 \end{aligned}$$

Johanna makes $300.

Ming:

$$\begin{aligned} 7t + 110 &= 7 \times 27 + 110 \\ &= 189 + 110 \\ &= 299 \end{aligned}$$

Ming makes $299.

c) $7t + 100 + 125 + 110 = 7t + 335$

d)

$$\begin{aligned} 7t + 335 &= 7 \times 72 + 335 \\ &= 504 + 335 \\ &= 839 \end{aligned}$$

$240 + 300 + 299 = 839$

The students make a total of $839. This is the same as the sum of the answers found in part b).

Chapter 3 Section 5 Question 11 Page 152

a) Yannick added the constants to the coefficients of the *x*-terms. He did not realize that 4 is an unlike term.

b) Answers will vary. A sample answer is shown.

You can substitute any value for *x* into the original expression and into the simplified expression, and show that they do not give the same result.

c) $3x + 4 + 6x = 9x + 4$. Verify by substituting a value for *x* into the expressions, and show that they give the same result.

Chapter 3 Section 5 Question 12 Page 153

a) $P = w + 3w + w + 3w$
$= 8w$

b) $P = 8 \times 300$
$= 2400$

The perimeter of the field is 2400 m.

c) $1600 = 8w$
$\frac{1600}{8} = \frac{8w}{8}$
$200 = w$

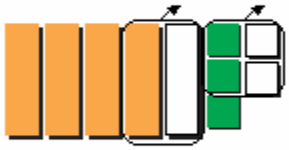
The width is 200 m, and the length is 3 × 200, or 600 m.

Chapter 3 Section 5 **Question 13 Page 153**

a) $3x+1+5x+4=$

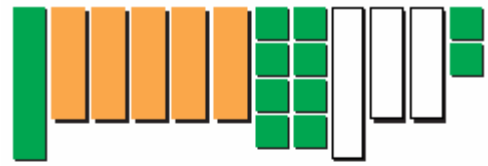
$8x+5$

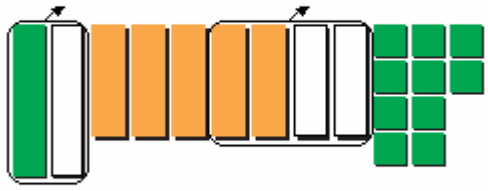
b) $4y+3-y-2=$



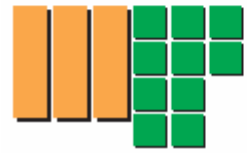
$3y+1$

c) $x+5y+8-x-2y+2=$





$3y+10$



Chapter 3 Section 5 Question 14 Page 153

a) The perimeter measures $w + 2w + w + 2w = 6w$.

The two white bars measure $\frac{1}{2}w + \frac{1}{2}w = w$.

The total length of white trim needed is $6w + w = 7w$.

b) For a crest of width 10 cm, the length of trim needed is 7(10), or 70 cm.

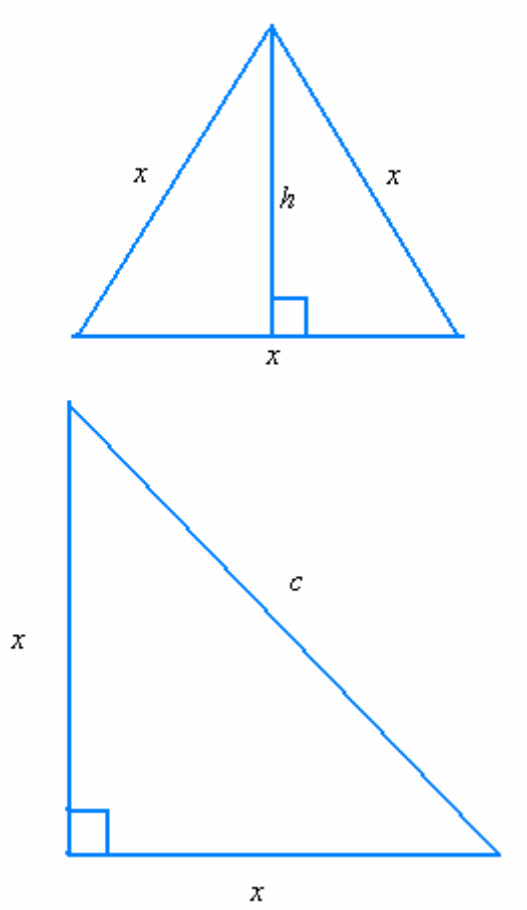
Chapter 3 Section 5 Question 15 Page 153

a) $P = x + x + x$
$= 3x$

b) $c^2 = x^2 + x^2$
$= 2x^2$
$c = \sqrt{2}x$

$P = x + x + \sqrt{2}x$
$= 2x + \sqrt{2}x$

The perimeter of the isosceles triangle is $2x + \sqrt{2}x$, which is greater than the perimeter of the equilateral triangle.



Chapter 3 Section 5 Question 16 Page 153

$$x^2 = h^2 + \left(\frac{1}{2}x\right)^2$$

$$x^2 = h^2 + \frac{1}{4}x^2$$

$$\frac{3}{4}x^2 = h^2$$

$$\frac{\sqrt{3}}{2}x = h$$

$$A = \frac{1}{2} \times \frac{\sqrt{3}}{2}x \times x$$

$$= \frac{\sqrt{3}}{4}x^2$$

The area of the isosceles triangle is x^2, which is greater than the area of the equilateral triangle, which is $\frac{\sqrt{3}}{4}x^2$.

Chapter 3 Section 5 Question 17 Page 153

The coefficient of the first term is increasing by 2. The coefficient for the 100th term will be $3 + 2 \times 99$, or 201.

The coefficient of the second term is increasing by 3. The coefficient for the 100th term will be $2 + 3 \times 99$, or 299.

The exponent of x is increasing by 1. The exponent for the 100th term will be $1 + 1 \times 99$, or 100.

The exponent of y is increasing by 2. The exponent for the 100th term will be $1 + 2 \times 99$, or 199.

The 100th term will be $201x^{100} + 299y^{199}$. Answer D.

Chapter 3 Section 5 Question 18 Page 153

Calculate the powers of 2. The last digit forms the pattern 2, 4, 8, 6, repeating after a cycle of 4.

$2^1 = 2$

$2^2 = 4$

$2^3 = 8$

$2^4 = 16$

$2^5 = 32$

$2^6 = 64$

$2^7 = 128$

$2^8 = 256$

The exponent 2020 occurs after $\frac{2020}{4} = 505$ cycles. The last digit in the expanded form will be 6.

Answer C.

Chapter 3 Section 6 Add and Subtract Polynomials

Chapter 3 Section 6 Question 1 Page 157

$$\begin{aligned}(2x-7)+(3x+8) &= 2x-7+3x+8\\ &= 2x+3x-7+8\\ &= 5x+1\end{aligned}$$

Answer C.

Chapter 3 Section 6 Question 2 Page 157

a) $$\begin{aligned}(3x+4)+(7x+5) &= 3x+4+7x+5\\ &= 3x+7x+4+5\\ &= 10x+9\end{aligned}$$

b) $$\begin{aligned}(y+2)+(3+6y) &= y+2+3+6y\\ &= y+6y+2+3\\ &= 7y+5\end{aligned}$$

c) $$\begin{aligned}(4m-1)+(3m-8) &= 4m-1+3m-8\\ &= 4m+3m-1-8\\ &= 7m-9\end{aligned}$$

d) $$\begin{aligned}(5-3d)+(d-6) &= 5-3d+d-6\\ &= -3d+d+5-6\\ &= -2d-1\end{aligned}$$

e) $$\begin{aligned}(4k-3)+(5+k)+(5k+3) &= 4k-3+5+k+5k+3\\ &= 4k+k+5k-3+5+3\\ &= 10k+5\end{aligned}$$

f) $$\begin{aligned}(6r-1)+(3r+2)+(-6r-1) &= 6r-1+3r+2-6r-1\\ &= 6r+3r-6r-1+2-1\\ &= 3r\end{aligned}$$

Chapter 3 Section 6 Question 3 Page 157

$$\begin{aligned}(3x-5)-(x-4) &= (3x-5)+(-x+4)\\ &= 3x-5-x+4\\ &= 3x-x-5+4\\ &= 2x-1\end{aligned}$$

Answer A.

Chapter 3 Section 6 **Question 4** **Page 157**

a) $(2x+3)-(x+6)=(2x+3)+(-x-6)$
$=2x+3-x-6$
$=2x-x+3-6$
$=x-3$

b) $(8s+5)-(s+5)=(8s+5)+(-s-5)$
$=8s+5-s-5$
$=8s-s+5-5$
$=7s$

c) $(6m+4)-(2m+1)=(6m+4)+(-2m-1)$
$=6m+4-2m-1$
$=6m-2m+4-1$
$=4m+3$

d) $(4v-9)-(8-3v)=(4v-9)+(-8+3v)$
$=4v-9-8+3v$
$=4v+3v-9-8$
$=7v-17$

e) $(9-6w)-(-6w-8)=(9-6w)+(6w+8)$
$=9-6w+6w+8$
$=-6w+6w+9+8$
$=17$

f) $(5h+9)-(-5h+6)=(5h+9)+(5h-6)$
$=5h+9+5h-6$
$=5h+5h+9-6$
$=10h+3$

Chapter 3 Section 6 Question 5 Page 157

a) $(7x-9)+(x-4)=7x-9+x-4$
$=7x+x-9-4$
$=8x-13$

b) $(3y+8)+(-y-5)=3y+8-y-5$
$=3y-y+8-5$
$=2y+3$

c) $(8c-6)-(c+7)=(8c-6)+(-c-7)$
$=8c-6-c-7$
$=8c-c-6-7$
$=7c-13$

d) $(k+2)-(3k-2)=(k+2)+(-3k+2)$
$=k+2-3k+2$
$=k-3k+2+2$
$=-2k+4$

e) $(3p^2-8p+1)+(9p^2+4p-1)=3p^2-8p+1+9p^2+4p-1$
$=3p^2+9p^2-8p+4p+1-1$
$=12p^2-4p$

f) $(5xy^2+6x-7y)-(3xy^2-6x+7y)=(5xy^2+6x-7y)+(-3xy^2+6x-7y)$
$=5xy^2+6x-7y-3xy^2+6x-7y$
$=5xy^2-3xy^2+6x+6x-7y-7y$
$=2xy^2+12x-14y$

g) $(4x-3)+(x+8)-(2x-5)=(4x-3)+(x+8)+(-2x+5)$
$=4x-3+x+8-2x+5$
$=4x+x-2x-3+8+5$
$=3x+10$

h) $(2uv^2-3v)-(v+3u)+(4uv^2-9u)=(2uv^2-3v)+(-v-3u)+(4uv^2-9u)$
$=2uv^2-3v-v-3u+4uv^2-9u$
$=2uv^2+4uv^2-3u-9u-3v-v$
$=6uv^2-12u-4v$

Chapter 3 Section 6 Question 6 Page 158

a)

Musician	Fixed Rate ($)	Royalty ($ for n CDs sold)
Ling	2000	$0.1n$
Fredrick	–	$0.3n$
Nigel	1500	$0.2n$
Tulia	5000	–

$$2000 + 0.1n + 0.3n + 1500 + 0.2n + 5000 = 8500 + 0.6n$$

b)

Status	Number of CDs Sold
Gold	50 000
Platinum	100 000
Diamond	1 000 000

100 copies: 8500 + 0.6(100) = 8560
If their CD sells 100 copies, the group is paid $8560.

Gold status: 8500 + 0.6(50 000) = 38 500
If their CD sells 50 000 copies, the group is paid $38 500.

Diamond status: 8500 + 0.6(1 000 000) = 608 500
If their CD sells 1 000 000 copies, the group is paid $608 500.

c)

Status	Number Sold	Ling	Frederick	Nigel	Tulia
Gold	50000	7000	15000	11500	5000
Platinum	100000	12000	30000	21500	5000
Diamond	1000000	102000	300000	201500	5000

Frederick makes the most money at each level in the table in part b).

d) Answers will vary. Sample answers are shown.

Fixed rate: If there are few sales, the musician still makes some money. However, if there are lots of sales, the musician does not profit as much as they would with other methods of payment.

Royalty: The more sales that are made, the more money the musician makes. The musician, however, will make no money if there are no sales.

Combination: The musician still gets the fixed rate if there are no sales but receives some royalties if there are sales. The downside is that the fixed rate is smaller than if they were just being paid by a fixed rate and the royalties rate is also smaller than if they were just receiving royalties.

Chapter 3 Section 6 **Question 7 Page 158**

a)

Player	Base Salary ($1000s)	3-Point Baskets
Gomez	50	25
Henreld	40	20
Jones	100	44

Total Earnings: $50\,000 + 40\,000 + 100\,000 + 100b = 190\,000 + 100b$

b) $E = 190\,000 + 100(25 + 20 + 44)$

$= 198\,900$

The total earnings for these players are $198 900.

Chapter 3 Section 6 **Question 8 Page 159**

a) $(2x+5)+(3x+2)=$

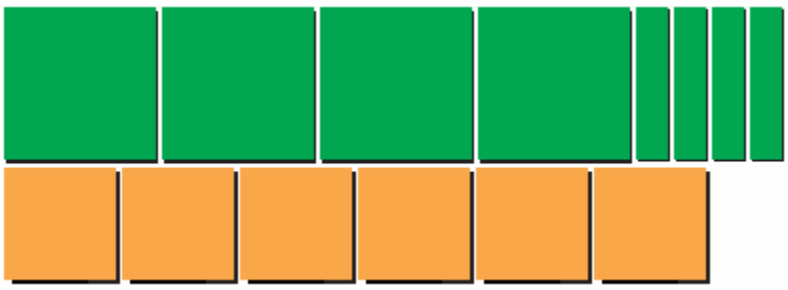
$5x+7$

b) $(y^2+3y+1)+(y^2+2y+2)=$

$2y^2+5y+3$

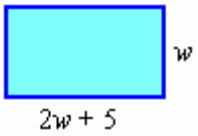
c) $(2x^2+3x+4y^2)+(2x^2+x+2y^2)=$

$4x^2+4x+6y^2$



Chapter 3 Section 6 Question 9 Page 159

a)



b) $P = w + 2w + 5 + w + 2w + 5$
$= 6w + 10$

c) $P = 6 \times 6 + 10$
$= 36 + 10$
$= 46$

The length of coping needed is 46 m.

Chapter 3 Section 6 Question 10 Page 159

a) Answers will vary. One possible prediction is that the length of coping will double.

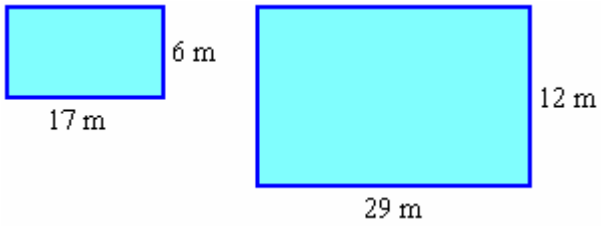
b) $P = 6 \times 12 + 10$
$= 82$

If the width is doubled, 82 m of coping are required. This is not double the amount in question 9. The amount does not double because the extra 5 m added to the width to form the length does not change when the width changes.

Chapter 3 Section 6 Question 11 Page 159

The proportions of the pool change when you change the width. The width is w, the length is $2w + 5$, and the perimeter is $6w + 10$. If the width is doubled, the length and perimeter are not doubled.

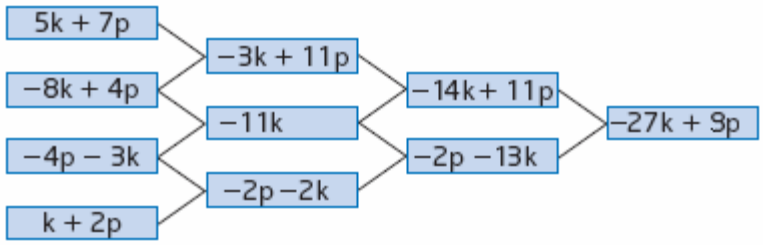
Example: for a width of 6 m, the length is 2(6) + 5, or 17 m, and the perimeter is 46 m. If the width is doubled to 12 m, the length is 2(12) + 5, or 29 m, and the perimeter is 82 m.



For the smaller pool, the ratio of length to width is 17:6. For the larger pool, it is 29:12. These are not the same.

Chapter 3 Section 6 **Question 12** **Page 159**

a)



b) Answers will vary.

Chapter 3 Section 7 The Distributive Property

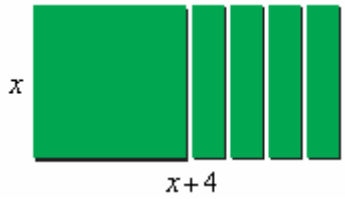
Chapter 3 Section 7 Question 1 Page 166

$-3(x+5) = -3x-15$ Answer D.

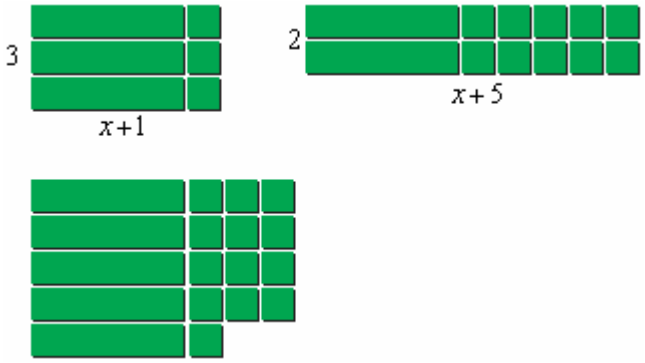
Chapter 3 Section 7 Question 2 Page 166

a) $2(x+3) = 2x+6$

b) $x(x+4) = x^2+4x$



c) $3(x+1)+2(x+5) = 3x+3+2x+10$
$= 5x+13$



Chapter 3 Section 7 Question 3 Page 166

a) $4(x+2) = 4(x)+4(2)$
$= 4x+8$

b) $5(k-3) = 5(k+(-3))$
$= 5(k)+5(-3)$
$= 5k+(-15)$
$= 5k-15$

c) $-2(y+1) = -2(y)-2(1)$
$= -2y-2$

d) $-8(2-d) = -8(2+(-d))$
$= -8(2)-8(-d)$
$= -16+8d$

e) $5(2t-3) = 5(2t+(-3))$
$= 5(2t)+5(-3)$
$= 10t+(-15)$
$= 10t-15$

f) $-(4y-5) = -1(4y+(-5))$
$= -1(4y)-1(-5)$
$= -4y+5$

Chapter 3 Section 7 Question 4 Page 166

a) $y(y-4) = y(y) + y(-4)$
$= y^2 - 4y$

b) $r(r+5) = r(r) + r(5)$
$= r^2 + 5r$

c) $x(2x-5) = x(2x) + x(-5)$
$= 2x^2 - 5x$

d) $q(-4q+8) = q(-4q) + q(8)$
$= -4q^2 + 8q$

e) $z(-3z+2) = z(-3z) + z(2)$
$= -3z^2 + 2z$

f) $m(-m-5) = m(-m) + m(-5)$
$= -m^2 - 5m$

Chapter 3 Section 7 Question 5 Page 166

a) $2b(3b-5) = 2b(3b) + 2b(-5)$
$= 6b^2 - 10b$

b) $3v(8v+7) = 3v(8v) + 3v(7)$
$= 24v^2 + 21v$

c) $-4w(3w-1) = -4w(3w) - 4w(-1)$
$= -12w^2 + 4w$

d) $-6m(-m-5) = -6m(-m) - 6m(-5)$
$= 6m^2 + 30m$

e) $2q(-4q+3) = 2q(-4q) + 2q(3)$
$= -8q^2 + 6q$

f) $-3d(-d+2) = -3d(-d) - 3d(2)$
$= 3d^2 - 6d$

Chapter 3 Section 7 Question 6 Page 166

a) $(n-5) \times 4 = n(4) + (-5)(4)$
$= 4n + (-20)$
$= 4n - 20$

b) $(2p+4) \times 9 = 2p(9) + 4(9)$
$= 18p + 36$

c) $(7m+6) \times (-4) = 7m(-4) + 6(-4)$
$= -28m + (-24)$
$= -28m - 24$

d) $(7+c)(3c) = 7(3c) + c(3c)$
$= 21c + 3c^2$

e) $(3-6w)(-2) = 3(-2) + (-6w)(-2)$
$= -6 + 12w$

f) $(4k+7)(-3k) = 4k(-3k) + 7(-3k)$
$= -12k^2 + (-21k)$
$= -12k^2 - 21k$

Chapter 3 Section 7 Question 7 Page 166

a) $2\left(a^2+5a+3\right)=2a^2+10a+6$

b) $-3\left(2n^2-8n+5\right)=-6n^2+24n-15$

c) $4k\left(k^2+k-3\right)=4k^3+4k^2-12k$

d) $-5h\left(3h^2-7h-2\right)=-15h^3+35h^2+10h$

e) $\left(x^2-5x+2\right)(-3)=-3x^2+15x-6$

f) $\left(2y^2+3y-1\right)(4y)=8y^3+12y^2-4y$

Chapter 3 Section 7 Question 8 Page 167

a)
$$\begin{aligned}3(x+2)+4(x-5)&=3(x)+3(2)+4(x)+4(-5)\\&=3x+6+4x-20\\&=3x+4x+6-20\\&=7x-14\end{aligned}$$

b)
$$\begin{aligned}-4(y+1)+2(2y-3)&=-4(y)-4(1)+2(2y)+2(-3)\\&=-4y-4+4y-6\\&=-4y+4y-4-6\\&=-10\end{aligned}$$

c)
$$\begin{aligned}2(u+v)-3(u-v)&=2(u)+2(v)-3(u)-3(-v)\\&=2u+2v-3u+3v\\&=2u-3u+2v+3v\\&=-u+5v\end{aligned}$$

d)
$$\begin{aligned}4(w-2)-2(2w+7)&=4(w)+4(-2)-2(2w)-2(7)\\&=4w-8-4w-14\\&=4w-4w-8-14\\&=-22\end{aligned}$$

e)
$$\begin{aligned}-3(a+b)-2(a-b)&=-3(a)-3(b)-2(a)-2(-b)\\&=-3a-3b-2a+2b\\&=-3a-2a-3b+2b\\&=-5a-b\end{aligned}$$

f)
$$\begin{aligned}2(p-q)+2(-p+q)&=2(p)+2(-q)+2(-p)+2(q)\\&=2p-2q-2p+2q\\&=2p-2p-2q+2q\\&=0\end{aligned}$$

Chapter 3 Section 7 Question 9 Page 167

a) $3\left[x+2\left(x-4\right)\right]=3\left[x+2x-8\right]$
$=3\left[3x-8\right]$
$=9x-24$

b) $5\left[2\left(y-1\right)-3\right]=5\left[2y-2-3\right]$
$=5\left[2y-5\right]$
$=10y-25$

c) $3\left[2k-\left(2+k\right)\right]=3\left[2k-2-k\right]$
$=3\left[k-2\right]$
$=3k-6$

d) $4\left[-3\left(r-5\right)+2r\right]=4\left[-3r+15+2r\right]$
$=4\left[-r+15\right]$
$=-4r+60$

e) $2\left[-h-2\left(h-1\right)\right]=2\left[-h-2h+2\right]$
$=2\left[-3h+2\right]$
$=-6h+4$

f) $-3\left[2\left(p+2\right)-3p\right]=-3\left[2p+4-3p\right]$
$=-3\left[4-p\right]$
$=-12+3p$

Chapter 3 Section 7 Question 10 Page 167

a) $30h+50$

b) $30h+50=30\left(2.5\right)+50$
$=75+50$
$=125$

A 2.5 h repair job will cost \$125.

c) $2\left(30h+50\right)=60h+100$

d) $60h+100=60\left(2.5\right)+100$
$=250$

The cost for a 2.5 h repair job on a holiday costs \$250. This makes sense. It is twice the answer from part b).

Chapter 3 Section 7 Question 11 Page 167

Niko is right. The order of operations always apply and if there is no other way to simplify the expression according to the order of operations, then the expression is in simplified form.

Chapter 3 Section 7 Question 12 Page 168

$A=\frac{1}{2}\left(a+b\right)h$
$=\frac{1}{2}ah+\frac{1}{2}bh$

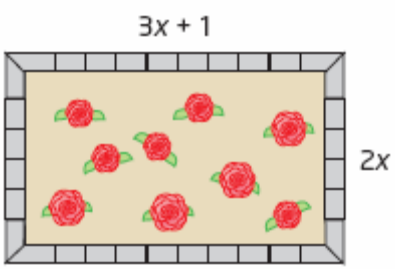
Chapter 3 Section 7 **Question 13** **Page 168**

a) $2(2x+3x+1)=2(5x+1)$
$=10x+2$

b) $2x(3x+1)=6x^2+2x$

c) $P=2(3(2x)+3(3x+1))$
$=2(6x+9x+3)$
$=2(15x+3)$
$=30x+6$

$A=3(2x)(3(3x+1))$
$=6x(9x+3)$
$=54x^2+18x$



d) The perimeter has tripled. Triple the old perimeter is $3(10x + 2)$ or $30x + 6$, which is equal to the new perimeter.

e) The area has not tripled. Triple the old area is $3(6x^2 + 2x)$ or $18x^2 + 6x$, which is not equal to the new area.

Chapter 3 Section 7 **Question 14** **Page 168**

The distributive property is true for numerical expressions. Examples will vary. A sample is shown.

$2(5-3)=2\times 2$
$=4$

$2(5-3)=2\times 5-2\times 3$
$=10-6$
$=4$

Chapter 3 Section 7 Question 15 Page 168

a) $2(x-3)+3(x+5)=2x-6+3x+15$
$=5x+9$

b) $3(k-4)-2(k+1)=3k-12-2k-2$
$=k-14$

c) $0.2p(p-5)+0.4p(3p-2)=0.2p^2-1.0p+1.2p^2-0.8p$
$=1.4p^2-1.8p$

d) $-4h(h+2)+h(2h-3)=-4h^2-8h+2h^2-3h$
$=-2h^2-11h$

e) $5j(j-3)-(2j^2-3j)=5j^2-15j-2j^2+3j$
$=3j^2-12j$

f) $-0.7w(2w-3)-0.6w(w+3)=-1.4w^2+2.1w-0.6w^2-1.8w$
$=-2.0w^2+0.3w$

g) $3(y-2)-2(4-2y)+(6-7y)=3y-6-8+4y+6-7y$
$=-8$

h) $4k(k-3)-2(k^2-3k+4)-(k^2-5)=4k^2-12k-2k^2+6k-8-k^2+5$
$=k^2-6k-3$

Chapter 3 Section 7 Question 16 Page 168

a) $\frac{1}{3}(3a+2)+\frac{1}{4}(4a-2)=\frac{1}{\cancel{3}_{1}}\left(\overset{1}{\cancel{3}}a\right)+\frac{1}{3}(2)+\frac{1}{\cancel{4}_{1}}\left(\overset{1}{\cancel{4}}a\right)+\frac{1}{\cancel{4}_{2}}\left(\overset{-1}{\cancel{-2}}\right)$

$=1(1a)+\frac{2}{3}+1(1a)+\frac{1}{2}(-1)$

$=a+\frac{2}{3}+a-\frac{1}{2}$

$=2a+\frac{1}{6}$

b) $\frac{1}{2}(x-2y)+\frac{1}{3}(3y-2x)=\frac{1}{2}(x)+\frac{1}{\cancel{2}_{1}}\left(\overset{-1}{\cancel{-2}}y\right)+\frac{1}{\cancel{3}_{1}}\left(\overset{1}{\cancel{3}}y\right)+\frac{1}{3}(-2x)$

$=\frac{1}{2}x+1(-1y)+1(1y)-\frac{2}{3}x$

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

$=-\frac{1}{6}$

c) $\frac{2}{3}(3m-2)-\frac{3}{4}(8m-2)=\frac{2}{\cancel{3}_{1}}\left(\overset{1}{\cancel{3}}m\right)+\frac{2}{3}(-2)-\frac{3}{\cancel{4}_{1}}\left(\overset{2}{\cancel{8}}m\right)-\frac{3}{4_{2}}\left(\overset{-1}{\cancel{-2}}\right)$

$=2(1m)-\frac{4}{3}-3(2m)-\frac{3}{2}(-1)$

$=2m-\frac{4}{3}-6m+\frac{3}{2}$

$=-4m+\frac{1}{6}$

d) $-\frac{1}{4}(4u-3v)-\frac{3}{5}(6u-10v)=-\frac{1}{\cancel{4}_{1}}\left(\overset{1}{4}u\right)-\frac{1}{4}(-3v)-\frac{3}{5}(6u)-\frac{3}{\cancel{5}_{1}}\left(\overset{-2}{\cancel{-10}}v\right)$

$=-1(1u)+\frac{3}{4}v-\frac{18}{5}u-3(-2v)$

$=-u+\frac{3}{4}v-\frac{18}{5}u+6v$

$=-\frac{23}{5}u+\frac{27}{4}v$

Chapter 3 Section 7 Question 17 Page 169

Solutions for the Achievement Checks are shown in the Teacher's Resource.

Chapter 3 Section 7 Question 18 Page 169

a) $2m\left[m-3(m+2)\right]=2m\left[m-3m-6\right]$
$=2m\left[-2m-6\right]$
$=-4m^2-12m$

b) $-3p\left[2p(p+4)+p^2\right]=-3p\left[2p^2+8p+p^2\right]$
$=-3p\left[3p^2+8p\right]$
$=-9p^3-24p^2$

c) $2\left[3+2(x-6)\right]+3\left[-2(x-5)+8\right]=2\left[3+2x-12\right]+3\left[-2x+10+8\right]$
$=2\left[2x-9\right]+3\left[-2x+18\right]$
$=4x-18-6x+54$
$=-2x+36$

d) $-3\left[2-(y-5)\right]-4\left[3(y+1)-(6-y)(-2)\right]=-3\left[2-y+5\right]-4\left[3y+3+12-2y\right]$
$=-3\left[7-y\right]-4\left[y+15\right]$
$=-21+3y-4y-60$
$=-81-y$

Chapter 3 Section 7 Question 19 Page 169

a) $(x+3)(2x)+(x+3)(-2)=2x^2+6x-2x-6$
$=2x^2+4x-6$

b) Answers will vary.

c) Answers will vary. A sample answer is shown.

Multiply the first term in the first binomial by each term in the second binomial, and then multiply the second term in the first binomial by each term in the second binomial. Simplify the resulting polynomial by collecting like terms.

Chapter 3 Section 7 Question 20 Page 169

$(k+1)(k^2-2k-1)=(k+1)k^2+(k+1)(-2k)+(k+1)(-1)$
$=k^3+k^2-2k^2-2k-k-1$
$=k^3-k^2-3k-1$

Chapter 3 Section 7 Question 21 Page 169

Use the "guess and check" method on your calculator to determine that $x = 6$.

Chapter 3 Review

Chapter 3 Review Question 1 Page 174

a) Each tile represents 1 km, for a total of 4.

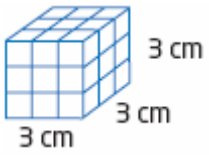
b) Each tile represents an unknown distance x, for a total of $2x$..

c) The x-tile represents the unknown distance, plus 3 unit tiles, for a total of $x + 3$.

d) Each tile represents the unknown amount of paint per coat, for a total of $2x$.

Chapter 3 Review Question 2 Page 174

a)



b) $V = 3^3$

$= 27$

The volume of the cube is 27 cm^3.

c) $A = 3^2$

$= 9$

The area of one face of the cube is 9 cm^2.

Chapter 3 Review **Question 3** **Page 174**

a) $4^5 = 1024$

b) $(-3)^4 = 81$

c) $\left(\frac{2}{5}\right)^3 = \frac{8}{125}$

d) $1.05^8 \doteq 1.4775$

Chapter 3 Review **Question 4** **Page 174**

a) $100(1.06)^n = 100(1.06)^5$
$\doteq 133.82$

The amount in the account after 5 years is \$133.82.

b) $100(1.06)^n = 100(1.06)^{10}$
$\doteq 179.08$

The amount in the account after 10 years is \$179.08.

Chapter 3 Review **Question 5** **Page 174**

$r = 1.06 - 1.00$
$= 0.06$
$= 6\%$

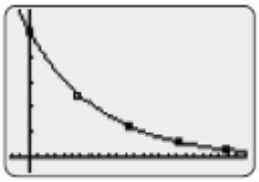
The annual rate of interest is 6%.

Chapter 3 Review **Question 6 Page 174**

a)

Number of Half-Life Periods	Years	Amount of C-14 Remaining (g)	Expression
0	0	50	
1	5 700	25	$50\left(\frac{1}{2}\right)^1$
2	11 400	12.5	$50\left(\frac{1}{2}\right)^2$
3	17 100	6.25	$50\left(\frac{1}{2}\right)^3$
4	22 800	3.125	$50\left(\frac{1}{2}\right)^4$

b)



The graph is non-linear. It is a curve, approaching the horizontal axis.

c) 20 000 years is $\frac{20\,000}{5700}$, or about 3.509 half-lives. Use your graph to interpolate an answer close to about 4.4 g.

d) Use your graph to extrapolate an answer close to about 5.6 half-lives, or 5.6×5700, or about 32 000 years.

Chapter 3 Review **Question 7 Page 174**

a) $2^3 \times 2^2 \times 2^4 = 2^{3+2+4}$
$= 2^9$
$= 512$

b) $6^7 \div 6^2 \div 6^3 = 6^{7-2} \div 6^3$
$= 6^5 \div 6^3$
$= 6^{5-3}$
$= 6^2$
$= 36$

c) $\left[(-4)^2\right]^3 = (-4)^{2\times 3}$
$= (-4)^6$
$= 4096$

d) $\dfrac{7^4 \times 7^5}{\left(7^4\right)^2} = \dfrac{7^{4+5}}{7^{4\times 2}}$
$= \dfrac{7^9}{7^8}$
$= 7^{9-8}$
$= 7^1$
$= 7$

Chapter 3 Review **Question 8 Page 175**

a) $\dfrac{n^5 \times n^3}{n^4} = \dfrac{n^{5+3}}{n^4}$
$= \dfrac{n^8}{n^4}$
$= n^{8-4}$
$= n^4$

b) $cd^3 \times c^4 d^2 = c^{1+4} d^{3+2}$
$= c^5 d^5$

c)
$$\frac{2ab^2 \times 3a^3b^3}{\left(4ab^2\right)^2} = \frac{6a^{1+3}b^{2+3}}{4^2a^2\left(b^2\right)^2}$$
$$= \frac{6a^4b^5}{16a^2b^{2\times 2}}$$
$$= \frac{6a^4b^5}{16a^2b^4}$$
$$= \frac{3}{8}a^{4-2}b^{5-4}$$
$$= \frac{3}{8}a^2b^1$$
$$= \frac{3}{8}a^2b$$

Chapter 3 Review **Question 9 Page 175**

a) The coefficient is 5, and the variable part is y.

b) The coefficient is 1, and the variable part is uv.

c) The coefficient is $\frac{1}{2}$, and the variable part is ab^2.

d) The coefficient is –1, and the variable part is de^2f.

e) The coefficient is 8, and there is no variable part.

Chapter 3 Review **Question 10 Page 175**

a) $x^2 + 3x - 5$ has 3 terms. It is a trinomial.

b) $24xy$ has one term. It is a monomial.

c) $a + 2b - c + 3$ has 4 terms. It is a four-term polynomial.

d) $-\frac{2}{3}$ has 1 term. It is a monomial.

e) $16u^2 - 7v^2$ has 2 terms. It is a binomial.

Chapter 3 Review **Question 11 Page 175**

a) The number of points is given by the expression $3w + 2o + l$, where w represents a win, o represents an overtime win, and l represents an overtime loss.

b)
$$\begin{aligned} 3w + 2o + l &= 3(4) + 2(1) + 2 \\ &= 12 + 2 + 2 \\ &= 16 \end{aligned}$$

The team earned 16 points.

Chapter 3 Review **Question 12 Page 175**

a) The degree of $3x^2$ is 2.

b) The degree of $6n^4$ is 4.

c) The degree of 17 is 0.

d) The degree of abc^2 is 4.

Chapter 3 Review **Question 13 Page 175**

a) The degree of $3y-5$ is 1.

b) The degree of $2d^2-d$ is 2.

c) The degree of $3w-6w^2+4$ is 2.

d) The degree of $3x^3-5x^2+x$ is 3.

Chapter 3 Review **Question 14 Page 175**

a) Like terms are $2p$, and p.

b) Like terms are $5x^2$, $-5x^2$, and $3x^2$.

Chapter 3 Review **Question 15 Page 175**

a) $4x-3+6x+5=4x+6x-3+5$
$=10x+2$

b) $7k+5m-k-6m=7k-k+5m-6m$
$=6k-m$

c) $6a^2-5a+3-3a^2+5a-4=6a^2-3a^2-5a+5a+3-4$
$=3a^2-1$

d) $3x^2-4xy+5y^2-6+3x^2+4xy-2=3x^2+3x^2-4xy+4xy+5y^2-6-2$
$=6x^2+5y^2-8$

Chapter 3 Review Question 16 Page 175

a) $(4x+3)+(3x-2)=4x+3+3x-2$
$=4x+3x+3-2$
$=7x+1$

b) $(5k-2)+(3k-5)=5k-2+3k-5$
$=5k+3k-2-5$
$=8k-7$

c) $(6u+1)-(2u+5)=(6u+1)+(-2u-5)$
$=6u+1-2u-5$
$=6u-2u+1-5$
$=4u-4$

d) $(y^2-3y)-(2y^2-5y)=(y^2-3y)+(-2y^2+5y)$
$=y^2-3y-2y^2+5y$
$=y^2-2y^2-3y+5y$
$=-y^2+2y$

e) $(2a^2-4a-2)-(a^2-4a+2)=(2a^2-4a-2)+(-a^2+4a-2)$
$=2a^2-4a-2-a^2+4a-2$
$=2a^2-a^2-4a+4a-2-2$
$=a^2-4$

f) $(3v-2)-(v-3)+(2v-7)=(3v-2)+(-v+3)+(2v-7)$
$=3v-2-v+3+2v-7$
$=3v-v+2v-2+3-7$
$=4v-6$

Chapter 3 Review Question 17 Page 175

$P=3x+2x-5+3x+2x-5$
$=3x+2x+3x+2x-5-5$
$=10x-10$

Chapter 3 Review **Question 18 Page 175**

a) $3(y-7)=3(y)+3(-7)$
$=3y-21$

b) $-2(x+3)=-2(x)-2(3)$
$=-2x-6$

c) $m(5m-3)=m(5m)+m(-3)$
$=5m^2-3m$

d) $-4k(2k+6)=-4k(2k)-4k(6)$
$=-8k^2-24k$

e) $-5(p^2+3p-1)=-5(p^2)-5(3p)-5(-1)$
$=-5p^2-15p+5$

f) $4b(b^2-2b+5)=4b(b^2)+4b(-2b)+4b(5)$
$=4b^3-8b^2+20b$

Chapter 3 Review **Question 19 Page 175**

a) $2(q-5)+4(3q+2)=2(q)+2(-5)+4(3q)+4(2)$
$=2q-10+12q+8$
$=2q+12q-10+8$
$=14q-2$

b) $5x(2x-4)-3(2x^2+8)=5x(2x)+5x(-4)-3(2x^2)-3(8)$
$=10x^2-20x-6x^2-24$
$=10x^2-6x^2-20x-24$
$=4x^2-20x-24$

c) $-3(2m-6)-(8-6m)=-3(2m)-3(-6)-1(8)-1(-6m)$
$=-6m+18-8+6m$
$=-6m+6m+18-8$
$=10$

d) $4(2d-5)+3(d^2-3d)-2d(d+1)=4(2d)+4(-5)+3(d^2)+3(-3d)-2d(d)-2d(1)$
$=8d-20+3d^2-9d-2d^2-2d$
$=3d^2-2d^2-9d+8d-2d-20$
$=d^2-3d-20$

Chapter 3 Review **Question 20 Page 175**

a) $2\left[4+3\left(x-5\right)\right]=2\left[4+3x-15\right]$

$=2\left[3x-11\right]$

$=6x-22$

b) $-3\left[9-2\left(k+3\right)+5k\right]=-3\left[9-2k-6+5k\right]$

$=-3\left[3+3k\right]$

$=-9-9k$

Chapter 3 Chapter Test

Chapter 3 Chapter Test Question 1 Page 176

$\left(\frac{1}{3}\right)^3 = \frac{1}{27}$

Answer D.

Chapter 3 Chapter Test Question 2 Page 176

$w^2 \times w^4 \times w = w^{2+4+1}$
$= w^7$

Answer B.

Chapter 3 Chapter Test Question 3 Page 176

$\frac{4^5}{4^3} = 4^{5-3}$
$= 4^2$
$= 16$

Answer C.

Chapter 3 Chapter Test Question 4 Page 176

$\left(2^3\right)^2 = 2^{3\times 2}$
$= 2^6$
$= 64$

Answer D.

Chapter 3 Chapter Test Question 5 Page 176

Answer C shows three like terms.

Chapter 3 Chapter Test Question 6 Page 176

$2k^2 - 3k$ has 2 terms. It is a binomial. Answer B.

Chapter 3 Chapter Test Question 7 Page 176

The degree of $2u^3v$ is 4. Answer D.

Chapter 3 Chapter Test Question 8 Page 176

$$\begin{aligned} 3x-5+2x+3 &= 3x+2x-5+3 \\ &= 5x-2 \end{aligned}$$

Answer B.

Chapter 3 Chapter Test Question 9 Page 176

$$\begin{aligned} -2m(3m-1) &= -2m(3m)-2m(-1) \\ &= -6m^2+2m \end{aligned}$$

Answer A.

Chapter 3 Chapter Test Question 10 Page 176

a) $$\begin{aligned} (-2)^2\times(-2)^3\times(-2) &= (-2)^{2+3+1} \\ &= (-2)^6 \\ &= 64 \end{aligned}$$

b) $$\begin{aligned} \frac{3^5\times3^3}{(3^2)^3} &= \frac{3^{5+3}}{3^{2\times3}} \\ &= \frac{3^8}{3^6} \\ &= 3^{8-6} \\ &= 3^2 \\ &= 9 \end{aligned}$$

Chapter 3 Chapter Test Question 11 Page 176

a) $$\begin{aligned} k^2n^3\times kn^4 &= k^{2+1}n^{3+4} \\ &= k^3n^7 \end{aligned}$$

b) $$\begin{aligned} -6p^5\div3p^2 &= -2p^{5-2} \\ &= -2p^3 \end{aligned}$$

c) $$\begin{aligned} (-3g^2h)^3 &= (-3)^3(g^2)^3h^3 \\ &= -27g^{2\times3}h^3 \\ &= -27g^6h^3 \end{aligned}$$

Chapter 3 Chapter Test Question 12 Page 176

a) $$\begin{aligned} (5x-3)+(2x+7) &= 5x-3+2x+7 \\ &= 5x+2x-3+7 \\ &= 7x+4 \end{aligned}$$

b) $$\begin{aligned} (3u-4)-(5u-1) &= (3u-4)+(-5u+1) \\ &= 3u-4-5u+1 \\ &= 3u-5u-4+1 \\ &= -2u-3 \end{aligned}$$

Chapter 3 Chapter Test Question 13 Page 176

a) $3(y+4)+6(y-2)=3(y)+3(4)+6(y)+6(-2)$

$=3y+12+6y-12$

$=3y+6y+12-12$

$=9y$

b) $-4(6b-3)-(3b+5)=-4(6b)-4(-3)-1(3b)-1(5)$

$=-24b+12-3b-5$

$=-24b-3b+12-5$

$=-27b+7$

Chapter 3 Chapter Test Question 14 Page 176

a) They are both correct. It is possible for the expressions to be equal. Use the distributive property to expand the right side of James's formula.

$P=2(l+w)$

$=2l+2w$

b) $P=l+l+w+w$

$P=l+w+l+w$

These can both be simplified to Sylvia's formula, which is equivalent to James's formula.

c) Answers will vary. A sample answer is shown.

They may have applied the paint too thickly, or they may have spilled some of the paint.

Chapter 3 Chapter Test Question 15 Page 177

a) On the first mailing, the email will go to 2 people. On the second mailing, the email will go to 2^2, or 4 people. On the third mailing, the email will go to 2^3, or 8 people. Continue the pattern to determine that on the seventh mailing the email will go to 2^7, or 128 people.

b) Continue the pattern to determine that on the ninth mailing the email will go to 2^9, or 512 people.

c) Use a table to determine how many people have received the email. Click here to load the spreadsheet.

Mailing	Number of People	Total Number of People
1	2	2
2	4	6
3	8	14
4	16	30
5	32	62
6	64	126
7	128	254
8	256	510
9	512	1022
10	1024	2046
11	2048	4094
12	4096	8190

d) From the table, it would take 8 mailings to reach all of the students.

Chapter 3 Chapter Test Question 16 Page 177

a) $3000 + 1500 + 2n + 1000 + 3n = 5500 + 5n$

Author	Fixed Rate ($)	Royalty ($ for n books sold)
Latoya	3000	–
Sven	1500	$2n$
Michelle	1000	$3n$

b) $5500 + 5n = 5500 + 5 \times 200$

$= 5500 + 100$

$= 6500$

$5500 + 5n = 5500 + 5 \times 5000$

$= 5500 + 25\,000$

$= 30\,500$

The publisher must pay the authors \$6500 if 200 copies are sold, and \$30 500 if 5000 copies are sold.

Chapter 3 Chapter Test Question 17 Page 177

a) Use a table to find a pattern. Click here to load the spreadsheet.

Square	Number of Pennies	Total Number of Pennies
1	1	1
2	2	3
3	4	7
4	8	15
5	16	31
6	32	63
7	64	127
8	128	255
9	256	511
10	512	1023
11	1024	2047
12	2048	4095

The number of pennies on the n^{th} square is 2^{n-1}. On the 64^{th} square, there are 2^{63} pennies.

b) The total number of pennies up to the n^{th} square is $2^n - 1$. The total number of pennies up to the 64^{th} square is $2^{64} - 1$.

Chapters 1 to 3 Review

Chapters 1 to 3 Review Question 1 Page 178

a) The next three terms are 11, 16, and 22. Add consecutive integers (1, 2, 3, …) to the previous term.

b) The next three terms are 25, 36, and 49. The sequence shows the number of the term squared. For example, term 2 is 2^2 or 4.

c) The next three terms are –3, –8, and –13. Subtract 5 from the previous term.

d) The next three terms are 30, 42, and 56. Add consecutive even integers, starting from 4 (4, 6, 8, 10, …), to the previous term.

Chapters 1 to 3 Review Question 2 Page 178

Strategy: Substitute the given value of 100 for C in equation 2 and solve for A.

A = 2.

Substitute A = 2 in equation 1 and solve for B.

B = 40.

Substitute B = 40 in equation 3.

D = $\frac{36}{40}$ or $\frac{9}{10}$.

Substitute D = $\frac{9}{10}$ into equation 4. and solve for E.

E = 20.

Chapters 1 to 3 Review Question 3 Page 178

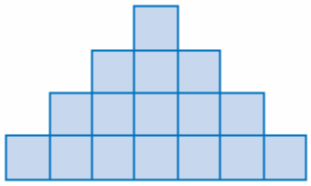
Use a table to organize the possible sums.

There are 14 different sums possible.

$5	$10	$20	Sum
0	0	0	0
1	0	0	5
2	0	0	10
3	0	0	15
0	1	0	10
1	1	0	15
2	1	0	20
3	1	0	25
0	0	1	20
1	0	1	25
2	0	1	30
3	0	1	35
0	0	2	40
1	0	2	45
2	0	2	50
3	0	2	55
0	1	1	30
1	1	1	35
2	1	1	40
3	1	1	45
0	1	2	50
1	1	2	55
2	1	2	60
3	1	2	65

Chapters 1 to 3 Review Question 4 Page 178

There are 16 squares. The area of each square is $\frac{400}{16} = 25$ cm^2.



The side length of each square is $\sqrt{25}$, or 5 cm.

Count the number of side lengths in the perimeter to find that the perimeter is 22 × 5 = 110 cm.

Chapters 1 to 3 Review Question 5 Page 178

a) $\frac{2}{3}-\frac{3}{4}\times\frac{1}{2}=\frac{2}{3}-\frac{3}{8}$

$=\frac{16}{24}-\frac{9}{24}$

$=\frac{7}{24}$

b) $\left(\frac{2}{3}-\frac{3}{4}\right)\times\frac{1}{2}=\left(\frac{8}{12}-\frac{9}{12}\right)\times\frac{1}{2}$

$=\left(-\frac{1}{12}\right)\times\frac{1}{2}$

$=-\frac{1}{24}$

c) $\frac{3}{4}-\frac{2}{3}\times\frac{1}{2}=\frac{3}{4}-\frac{1}{3}$

$=\frac{9}{12}-\frac{4}{12}$

$=\frac{5}{12}$

d) $\left(\frac{3}{4}-\frac{2}{3}\right)\times\frac{1}{2}=\left(\frac{9}{12}-\frac{8}{12}\right)\times\frac{1}{2}$

$=\left(\frac{1}{12}\right)\times\frac{1}{2}$

$=\frac{1}{24}$

Chapters 1 to 3 Review Question 6 Page 178

$\text{Mean}=\frac{-6+2-8-5+4+1-9}{7}$

$=\frac{-21}{7}$

$=-3$

The mean high temperature was –3ºC.

Chapters 1 to 3 Review Question 7 Page 178

The next perfect number is 28.

Strategy: A prime number cannot be a perfect number. Skip all prime numbers. Factor each number and calculate the sum of the factors.

8: 1 + 2 + 4 = 7
9: 1 + 3 = 4
10: 1 + 2 + 5 = 8
12: 1 + 2 + 3 + 4 + 6 = 16
14: 1 + 2 + 7 = 10
15: 1 + 3 + 5 = 9
16: 1 + 2 + 4 + 8 = 15
18: 1 + 2 + 3 + 6 + 9 = 21
20: 1 + 2 + 4 + 5 + 10 = 22
21: 1 + 3 + 7 = 11
22: 1 + 2 + 11 = 14
24: 1 + 2 + 3 + 4 + 6 + 8 +12 = 34
25: 1 + 5 = 6
26: 1 + 2 + 13 = 16
27: 1 + 3 + 9 = 13
28: 1 + 2 + 4 + 7 + 14 = 28

Chapters 1 to 3 Review Question 8 Page 178

Answers will vary. A sample answer is shown.

Count how many breaths you take in a minute, multiply by the number of minutes in an hour, hours in a day, and days in a year (number of breaths = 60 × 24 × 365).

Chapters 1 to 3 Review Question 9 Page 178

Five odd numbers cannot add to 50. Every odd number can be represented as the sum of an even number and 1. Let the odd numbers be represented by $a+1$, $b+1$, $c+1$, $d+1$, and $e+1$. Their sum is $a+1+b+1+c+1+d+1+e+1=a+b+c+d+e+5$. The sum of even numbers is an even number, so $a+b+c+d+e$ is an even number. The sum of an even number plus an odd number is an odd number, so $a+b+c+d+e+5$ is an odd number. Thus, five odd numbers cannot have a sum of 50.

Since the sum of five odd numbers must be an odd number, the sum of six odd numbers is an odd number plus an odd number, which gives an even number. So, six odd numbers can have a sum of 50. An example is $3+5+7+9+11+13+15=50$.

Chapters 1 to 3 Review Question 10 Page 178

a) Answers will vary. Example: 4 + 9 = 13.

b) Answers will vary. Example: 10° + 20° = 30°.

c) Answers will vary. Example: 2 + 7 = 9.

Chapters 1 to 3 Review Question 11 Page 178

a) Answers will vary.

b) Answers will vary. A sample answer is shown.

Conduct a stratified random sample survey by grade of your school. This is primary data.

Chapters 1 to 3 Review Question 12 Page 178

a) Answers will vary. A sample answer is shown.

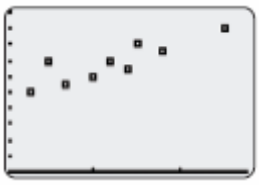
Take a simple random sample of 20% of the grade 9 girls.

b) Answers will vary. A sample answer is shown.

Take a stratified random sample by grade.

Chapters 1 to 3 Review Question 13 Page 178

a)



b) The taller the student, the greater the shoe size.

c) There are no outliers. Outliers should not be disregarded unless the data were inaccurate or unrepresentative.

Height (cm)	Shoe Size
157	5.5
153	5
165	8
160	6
175	9
162	7
164	6.5
155	7
168	7.5
162	7

Chapters 1 to 3 Review Question 14 Page 179

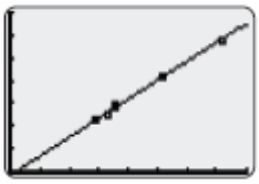
a) The population is all 50 employees at the store.

b) Answers will vary. The manager can randomly select 20% of the female employees and 20% of the male employees.

Chapters 1 to 3 Review Question 15 Page 179

a)

b)



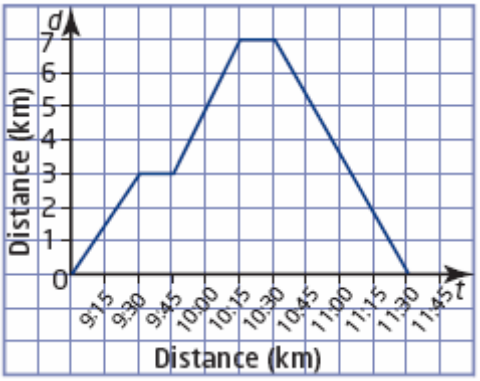
c) The greater the number of storeys, the taller the building.

d) Answers will vary. A reasonable answer is 160 m.

Building	Number of Storeys	Height (m)
First Canadian Place, Toronto	72	290
Manulife Place, Toronto	36	146
Petro-Canada Centre, West Tower, Calgary	52	210
Place de Ville, Ottawa	29	112
Royal Centre Tower, Vancouver	36	140
Toronto Dominion Centre, Winnipeg	33	126

Chapters 1 to 3 Review Question 16 Page 179

Starting at 9:00, Claire ran at $\frac{3}{0.5}$, or 6 km/h until 9:30, then stopped for 15 min. She then ran at a speed of $\frac{8}{0.5}$, or 8 km/h until 10:15 when she stopped again for 15 min. Claire then ran back home at $\frac{7}{1}$, or 7 km/h. She arrived home at 11:30.



Chapters 1 to 3 Review Question 17 Page 179

a) The side length of the cube is $\sqrt{64}$, or 8 cm.

b) The volume of the cube is 8^3, or 512 cm^3.

Chapters 1 to 3 Review Question 18 Page 179

a) $3^2 + 2^3 = 9 + 8$
$= 17$

b) $5^2 - 6^2 \div 2^2 = 25 - 36 \div 4$
$= 25 - 9$
$= 16$

c) $\left(4^3 - 3^3\right) + \left(2^5 \div 4^2\right) = (64 - 27) + (32 \div 16)$
$= 37 + 2$
$= 39$

d) $\left(\frac{3}{5}\right)^2 \div \frac{9}{10} = \frac{9}{25} \times \frac{10}{9}$
$= \frac{10}{25}$
$= \frac{2}{5}$

Chapters 1 to 3 Review Question 19 Page 179

a) $n^2 \times n^3 = n^{2+3}$
$= n^5$

b) $d^8 \div d^2 = d^{8-2}$
$= d^6$

c) $\left(a^3\right)^4 = a^{3\times 4}$
$= a^{12}$

d) $3m^2n \times 4mn^3 = 12m^{2+1}n^{1+3}$
$= 12m^3n^4$

e) $24k^5q^3 \div \left(2k^2q\right)^2 = 24k^5q^3 \div 2^2\left(k^2\right)^2 q^2$
$= 24k^5q^3 \div 4k^{2\times 2}q^2$
$= 24k^5q^3 \div 4k^4q^2$
$= 6k^{5-4}q^{3-2}$
$= 6kq$

Chapters 1 to 3 Review Question 20 Page 179

a) $10c - 5i$

b) $10c - 5i = 10 \times 12 - 5 \times 5$
$= 120 - 25$
$= 95$

Theo received a total score of 95.

Chapters 1 to 3 Review Question 21 Page 179

a) $5m+8-3m-10 = 5m-3m+8-10$
$= 2m-2$

b) $3x^2+6x-3-x^2-5x-1 = 3x^2-x^2+6x-5x-3-1$
$= 2x^2+x-4$

c) $(h+5)-(3h-8) = (h+5)+(-3h+8)$
$= h+5-3h+8$
$= h-3h+5+8$
$= -2h+13$

d) $(4t+5w)+(t-2w)-(3t+4w) = (4t+5w)+(t-2w)+(-3t-4w)$
$= 4t+5w+t-2w-3t-4w$
$= 4t+t-3t+5w-2w-4w$
$= 2t-w$

Chapters 1 to 3 Review Question 22 Page 179

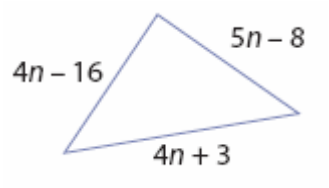
a) $5(x+3) = 5(x)+5(3)$
$= 5x+15$

b) $k(2k-1) = k(2k)+k(-1)$
$= 2k^2-k$

c) $4(3y+2)+3(2y-7) = 4(3y)+4(2)+3(2y)+3(-7)$
$= 12y+8+6y-21$
$= 12y+6y+8-21$
$= 18y-13$

d) $\frac{2}{3}(3a+1)+\frac{1}{2}(4a-1) = \frac{2}{\cancel{3}_{1}}\left(\cancel{3}^{1}a\right)+\frac{2}{3}(1)+\frac{1}{\cancel{2}_{1}}\left(\cancel{4}^{2}a\right)+\frac{1}{2}(-1)$
$= 2(1a)+\frac{2}{3}+1(2a)-\frac{1}{2}$
$= 2a+\frac{2}{3}+2a-\frac{1}{2}$
$= 4a+\frac{1}{6}$

Chapters 1 to 3 Review Question 23 Page 179



a) $4n-16+5n-8+4n+3=4n+5n+4n-16-8+3$

$=13n-21$

b) $13n-21=13\times 5-21$

$=65-21$

$=44$

The perimeter is 44 units.