Review of Essential Skills- Part 1

Operations with Rational Numbers, page 4

4. (e) $-8\frac{3}{32}$

Exponent Laws, page 6

2. (a) $3^0 + 5^0$, 2

(d) $(2)\left(\frac{3}{2}\right)$, 3

(e) $\frac{1}{2^2} + \frac{1}{2^3}, \frac{3}{8}$

(h) $\frac{\frac{1}{2}+\frac{1}{3}}{\frac{1}{9}}, \frac{15}{2}$

4. (h) x^4

5. (d) $-\frac{v^5}{2}$

Expanding, Simplifying, and Factoring Algebraic Expressions, page 8

1. (f) $x^3 - 9y^2$

3. (b) $-34h^2 - 23$

6. (f) question may be wrong

7. (i) $4(5x - 1)(x + 1)$

Solving Linear and Quadratic Equations Algebraically, page 10

1. (f) $y = 16$

(h) $n = 5$

2. (d) $y = 21$

Practise, Apply, Solve 1.1, page 21

9. (a) 1.414 213 562, 1.189 207 115, 1.090 507 733, 1.044 273 782, 1.021 897 149, 1.010 889 286, 1.005 429 901, 1.002 711 275, 1.001 354 720, 1.000 677 130

11. (c) *Example*: $t_n = 3n$; $t_n = 4.5 + 1.5(-1)^n$; $t_n = 3(2)^{n-1}$; $t_n = \frac{1}{2}n^2 + \frac{3}{2}n + 1$

23. (b) *Example*: The number of toothpicks is $2h(h + 1)$, where h is the number of toothpicks per side.

Practise 1.2, page 26

(d) 1, 1.414 213 562, 1.732 050 808, 2, 2.236 067 977, 2.449 489 743, 2.645 751 311, 2.828 427 125, 3, 3.162 277 660

Practise 1.4, page 38

Part 1

(c) $t_{10} = 0.1$, $t_{15} \doteq 0.067$, $t_{20} = 0.05$

(d) $t_{10} = 3.162$, $t_{15} \doteq 3.873$, $t_{20} \doteq 4.472$

(g) $t_{10} = 25.937$, $t_{15} \doteq 41.772$, $t_{20} \doteq 67.275$

(h) $t_{10} = 0.009\,766$, $t_{15} \doteq 0.000\,305\,2$, $t_{20} \doteq 0.000\,009\,537$

Practise, Apply, Solve 1.7, page 57

8. (a) dots in first quadrant curving up to right through (1, 1)

(b) dots in fourth quadrant curving down to right through (1, –2)

(c) dots in first quadrant curving up to left through (1, 5)

(d) dots alternating above and below x-axis in increasing magnitude to right through (1, 12)

(e) dots in first quadrant curving up to right through (1, 500)

(f) dots in first quadrant curving up to right through (1, 4)

(g) dots in first quadrant curving up to right through (1, 0.125)

(h) dots in fourth quadrant curving down to right through (1, –100)

Practise, Apply, Solve 1.10, page 85

8. (e) $-5m^2n^{-4}$

Chapter 1, Review and Practice, page 98

5. (a) dots in first quadrant in straight line through (1, 5) and (2, 9)

(b) dots in first quadrant curving up to right through (1, 0)

(c) dots in first quadrant curving up to right through (1, 1)

(d) dots in fourth quadrant in straight line through (1, –1) and (2, –4)

(e) dots in first quadrant curving up to right through (1, 3)

(f) dots in first quadrant curving up to left through (1, 10)

Chapter 1 Review Test, page 104

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

Practise, Apply, Solve 2.3, page 123

17. (a)

$$4S_7 - S_7 = 4(2 + 8 + 32 + 128 + 512 + 2048 + 8192) - (2 + 8 + 32 + 128 + 512 + 2048 + 8192)$$

$$3S_7 = 32\,768 - 2$$

$$S_7 = \frac{32\,766}{3}$$

$$S_7 = 10\,922$$

(b) $S_7 = \frac{a(r^7 - 1)}{r - 1}$

$= \frac{2(4^7 - 1)}{4 - 1}$

$= \frac{2(16\,383)}{3}$

$= 10\,922$

Practise 2.4, page 128

(b) nonlinear with points (quarter, balance) at {(1, 8160), (2, 8323.20), (3, 8489.66), ..., (40, 17 664.32)}

A	B	C	D
1 Period	Prev.	Int.	Quarterly
2	Bal.	8.0%/a	Balance
3 1	8000	= B3 * 0.02	= B3 + C3
4 = A3 + 1	= D3	= B4 * 0.02	= B4 + C4
		Total Interest after 8 years = $7076.32	**Balance after 8 years = $15 076.32**

(d)

A	B	C	D
1 Period	Prev.	Int.	Monthly
2	Bal.	6.0%/a	Balance
3 1	30 000	= B3 * 0.005	= B3 + C3
4 = A3 + 1	= D3	= B4 * 0.005	= B4 + C4
			Balance after 10 years = $54 581.90

Practise, Apply, Solve 2.7, page 151

7. 4 years, each divided into 4 equal segments. Amount of each payment, proceeding from most recent to first: 1600, $1600(1.025)^1$, $1600(1.025)^2$, ..., $1600(1.025)^{15}$

8. (d) 7 years, each divided into 2 equal segments. Amount of each payment, proceeding from most recent to first: 4300, $4300(1.0475)^1$, $4300(1.0475)^2$, ..., $4300(1.0475)^{13}$;
$A = 4300 + 4300(1.0475) + ... + 4300(1.0475)^{13}$;
$82 826.66

9. (d) $A = 4300(1.0475)^1 + 4300(1.0475)^2 + ... + 4300(1.0475)^{14}$
$= $86 760.92

Practise, Apply, Solve 2.8, page 163

6. (c) 3 years, each divided into 52 segments. Present value of each payment, proceeding from most recent to first: $60(1.25)^{-156}$, $60(1.25)^{-155}$, $650(1.25)^{-154}$, ..., $60(1.25)^{-1}$
$P = 60(1.25)^{-156} + 60(1.25)^{-155} + ... + 60(1.25)^{-1}$, $240.00

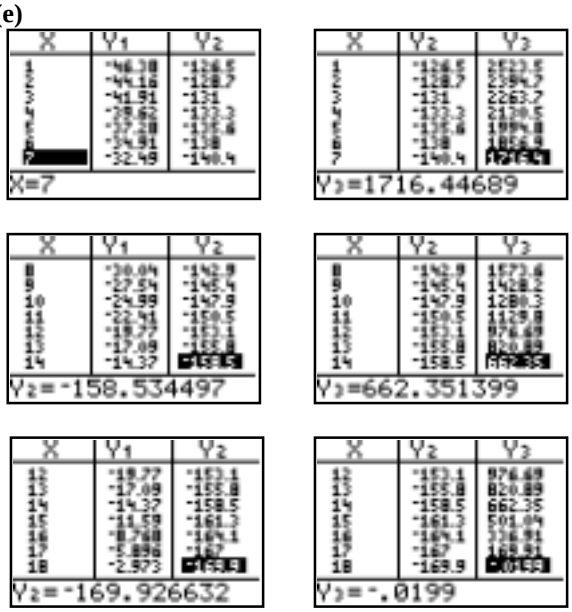
8. (b) $P = R(1.025)^{-15} + R(1.025)^{-14} + ... + R(1.025)^{-1}$

20. (b) 21.99% compounded annually

Practise 2.11, page 186

(c) $1280.32

(e)



Chapter 2, Review and Practice, page 197

3. (a) 2040

7. $t_n = ar^{n-1}$

15. (c) about 22 months; $101.27

(d) $2831.27

22. (a) *n* years each divided into 12 segments. Amount of each payment, proceeding from most recent to first: 475, $475(1.005)^1$, $475(1.005)^2$, ..., $475(1.005)^{n-2}$, $475(1.005)^{n-1}$, $475(1.005)^n$

30. (d) $161.92

34. (a) $624.92

36. (a) $1459.37

(b) year 1: $179 781.71
year 2: $177 368.55
year 3: $174 743.39
year 4: $171 887.61
year 5: $168 780.96

(c) $209.10, $415.00

(d) $1195.25

(e) $139 573.91

Cumulative Review Test 1, page 205

2. (b) $t_n = 50\,000 + 2000n$

3. (a) $t_{15} = -86\,093\,442$

10. (c) 26 months: final payment: $140.06

(d) $5640.06

(e) $433.24

13. (b) $192 209.93

(c) $35 063.88

15U. (a) $t_n = 350 + 0.32(t_n - 1)$
(c) an infinite length of time

Review of Essential Skills- Part 2

Using Properties of Relations to Sketch Their Graphs, page 211

1. (d) straight line through (0, –12) and (18, 0); $x = 18$, $y = -12$

2. (d) straight line through $\left(-\frac{1}{6}, 0\right)$ and (0, 1.5); $m = 9$, $b = \frac{3}{2}$

3. (a) parabola opening up, vertex (1.5, 0.5) through (0, 5) and (3, 5)
(c) parabola opening up, vertex (–0.5, –4.25) through (–1, –3) and (0, –3)

4. (b) parabola opening up, vertex (3.5, –2.25) through (2, 0) and (5, 0)

5. (a) parabola opening up, vertex (2, 3) through (0, 7) and (4, 7)

Completing the Square to Convert to the Vertex Form of a Parabola, page 212

2. (a) $(x + 1)^2 + 1$

3. (d) $y = -\frac{1}{2}(x - 5)^2 + \frac{29}{2}$

Solving Quadratic Equations: The Quadratic Formula, page 214

2. (b) $m = \frac{-27 \pm \sqrt{471}i}{30}$

Practise, Apply, Solve 3.2, page 234

16. (d) One curve in the first quadrant going down with a negative slope through (1, 1); second curve in second quadrant going up with a positive slope through (–1, 1)
D = $\{x \mid x \neq 0, x \in \mathbf{R}\}$, R = $\{y \mid y > 0, y \in \mathbf{R}\}$; function passes vertical line test

18. (b) D = $\{x \mid 0 \leq x \leq 200, x \in \mathbf{R}\}$

26. (c) 0.943 559 740 25,...

Practise, Apply, Solve 3.3, page 245

1. (i) solid line between closed dots at –4 and 4

8. $1 - x \leq -3$
$-x \leq -4$
$x \geq 4$

9. D = $\{x \mid -2 < x < 3, x \in \mathbf{R}\}$, R = $\{y \mid 3 < y < 8, y \in \mathbf{R}\}$

Practise, Apply, Solve 3.4, page 255

4. (h) connected points: (4, 3) to (3, 0.5) to (2, 1.5) to (1.8, –1) to (1, –0.5) to (1, –3) to (–1, –1)

5. (e) (–1, –1), (2, 2) and (5, 5)

(g) intersect at (2, –1), (–1, 2) and $\left(\frac{1}{3}, 0\right)$

Practise 3.5, page 264

2. ii. $f^{-1}(x) = \pm\sqrt{\frac{x+2}{3}} + 1$

iv. (c) D = $\{x \mid 0.4 \leq x \leq 2.3, x \in \mathbf{R}\}$;

7. (c) $g^{-1}(x) = (x - 3)^2$

8. (c) $f^{-1}(x) = x^2 + 2$

Practise, Apply, Solve 3.7, page 285

9. curve in first quadrant down to right through (1, 1), curve in third quadrant down to right through (–1, –1)

12. (b) $y = 3\sqrt{-(x - 5)} - 2$

Chapter 3, Review and Practice, page 293

6. (a) solid line between closed dot at –2 and open dot at 4

17. (b) $x = \sqrt{3 - 2y}, x \leq \frac{3}{2}$

(c) f^{-1} is $y = \frac{3 - x^2}{2}, y \leq \frac{3}{2}$

21. (a) $x \rightarrow \boxed{\times \frac{1}{2}} \rightarrow \boxed{-3} \leftarrow \boxed{g} \rightarrow \boxed{\times -1} \rightarrow \boxed{+1} \rightarrow y$

Chapter 3 Review Test, page 297

6. (c) $g^{-1}(x) = \pm\sqrt{-x + 5} + 3$

8. (b) point from (0.5, –1) to (–0.5, –1) to (–1, 5) to (–2, –3) to (–3, –7)

Chapter 4 Getting Ready, page 302

1. (f) $-\frac{57}{15}$

(i) $-\frac{185}{64}$

(l) $-\frac{217}{240}$

7. (b) $6m^2n^2(3m + 2n)$

(c) $3p^3q^2r(5pr + 7pqr)$

(d) $(x - 5)(x - 4)$

(e) $(y + 4)(y - 8)$

(f) $3(x + 3)(x + 5)$

(g) $21(x + 2)(x - 1)$

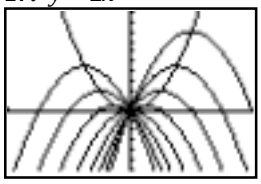
(h) $(x - 7)(x + 7)$
(i) $2(5x - 6)(5x + 6)$
(j) $(3x - 1)^2$
(k) $(2x - 3)(x + 2)$
(l) $(2a - 1)(5a + 3)$
8. (f) line, x-intercept: 3, y-intercept:–5

Practice 4.1, page 306

3. (a) $f(x) = (x - 2)^2 - 1$
(c) $f(x) = 3(x - 1)^2 - 2$
9. (d) $\left(\frac{1}{14}, -\frac{39}{98}\right)$
10. vertical stretch with factor 0.4; horizontal shift 2.5 units to the right; vertical shift 1 unit up

Practise, Apply, Solve 4.2, page 314

4. (a) $R(x) = -x^2 + 7x$; \$12 250
(b) $R(x) = -3x^2 + 11x$; \$10 081.50
(c) $R(x) = -0.4x^2 + 14x$, \$122 500
10. Complete the square to find minimum possible value for $f(x)$. $f(x)$ has a minimum value since $a > 0$; min possible value is 1.
11. opens downward; the x-coordinate of the vertex is always between the x-coordinates of the vertices for $f(x)$ and $g(x)$. The y-coordinate of the vertex for $f(x) + g(x)$ may be above, between, or below $f(x)$ and $g(x)$, depending on its positions.
12. (a) 37
13. (a) A line going through the first quadrant with the equation: $y = -1.918\,792\,67x + 29.326\,985\,27$
(b) $R(x) = -2x^2 + 29x$
(c) $P(x) = -2x^2 + 20x - 44$ or $P(x) = -2(x - 5)^2 - 6$; when $x = 5$, then 5000 pizzas should be sold to maximize profit.
14. (b) $y(x) = -344x^2 + 965x - 243$
17. $y = 2x^2$



Practise, Apply, Solve 4.3, page 325

13. 3168 items
16. graphically: Create the profit function, $P(x) = R(x) - C(x)$, where $R(x)$ is the quadratic revenue and $C(x)$ is the linear cost function. $P(x)$ will be a quadratic function. Graph the profit function and find the zeros.
17. The function will have two zeros regardless of k's value.

Practise, Apply, Solve 4.4, page 331

5. (e) $5.66i$
(f) $7.07i$
6. (e) $0.25 \pm 0.66i$
(f) $-1 \pm 2.24i$
9. (c) $1 \pm \frac{2}{3}\sqrt{6}$
(d) $1 \pm 2i$
11. (a) $(x + 2 - i)(x + 2 + i)$
17. sum of two complex numbers may be real or complex, when two complex conjugates are added, the result is always a real number; product of two complex numbers may be real or complex, when two complex numbers multiplied, result is always a real number; answers will vary

Practise, Apply, Solve 4.6, page 345

4. (a) x-intercept: 4
8. (c) $W = VI$, where I and W are linear
9. (b) $f^{-1}(x) = \frac{1}{x} - 2$
15. (a) $\frac{1}{f(x)} = \frac{1}{2x + 1}$, $f^{-1}(x) = \frac{x - 1}{2}$
D of $f = x \in \mathbf{R}$, R of $f = y \in \mathbf{R}$;
D of $\frac{1}{f} = \{x \mid x \neq -\frac{1}{2}, x \in \mathbf{R}\}$, R of $\frac{1}{f} = \{y \mid y \in \mathbf{R}\}$;
D of $f^{-1} = x \in \mathbf{R}$, R of $f^{-1} = y \in \mathbf{R}$
(b) $\frac{1}{f(x)} = \frac{1}{x^2 - 1}$, $f^{-1}(x) = \pm\sqrt{x + 1}$
D of $f = x \in \mathbf{R}$, R of $f = \{y \mid y \geq 1, y \in \mathbf{R}\}$;
D of $\frac{1}{f} = \{x \mid x \neq \pm 1, x \in \mathbf{R}\}$,
R of $\frac{1}{f} = \{y \mid y > 0 \text{ or } y \leq -1, y \in \mathbf{R}\}$;
D of $f^{-1} = \{x \mid x \geq -1, x \in \mathbf{R}\}$, R of $f^{-1} = y \in \mathbf{R}\}$
(c) $\frac{1}{f(x)} = \frac{1}{\sqrt{x - 4} - 3}$, $f^{-1}(x) = (x + 3)^2 + 4$
D of $f = \{x \mid x \geq 4, x \in \mathbf{R}\}$, R of $f = \{y \mid y \geq -3, y \in \mathbf{R}\}$;
D of $\frac{1}{f} = \{x \mid x \neq 13, x \in \mathbf{R}\}$,
R of $\frac{1}{f} = \{y \mid y \neq 0, y \in \mathbf{R}\}$;
D of $f^{-1} = \{x \mid x \geq -3, x \in \mathbf{R}\}$,
R of $f^{-1} = \{y \mid y \geq 4, y \in \mathbf{R}\}$
18. $(x, A(x)) = (1, 0), (2, 0.69), (3, 1.1), (4, 1.39), (5, 1.61), (6, 1.79), (7, 1.95), (8, 2.08), (9, 2.20), (10, 2.30), (11, 2.40), (12, 2.48)$

Practise, Apply, Solve 4.8, page 353

4. (a) 1, $y \neq -x$
(b) –1, $y \neq x$
(c) 1, $y \neq x$
(d) 1, $x \neq -y$
(e) 1, $x \neq y$
(f) –1, $x \neq y$
9. (d) $\frac{x-5y}{x+5y}, x \neq \pm 5y$
14. (a) 20 mg
(b) 17.36 mg
15. $\frac{\text{Surface Area}}{\text{Volume}} = \frac{2(r+h)}{rh}, r \neq 0, h \neq 0$
16. No, he made his error by incorrectly factoring the numerator.

Practise, Apply, Solve 4.9, page 359

1. (a) $\frac{xy}{12}$
(b) $\frac{10a}{b}, a \neq 0, b \neq 0$
(c) $9x$, $x \neq 0$, $y \neq 0$
(d) $\frac{4}{3}$, $p \neq 0$, $q \neq 0$
(e) $2y^2$, $x \neq 0$, $y \neq 0$
2. (a) $\frac{4a}{3b}$, $b \neq 0$
(b) $\frac{3m}{2}$, $m \neq 0$, $n \neq 0$
(c) $-\frac{21}{8a^2b}$, $a \neq 0$, $b \neq 0$
(d) $\frac{9r}{4p^2q^2}$, p, q, $r \neq 0$
(e) $\frac{a}{2b}$, $a \neq 0$, $b \neq 0$
3. (a) 2, $x \neq 0$, 2
(b) $\frac{5(y-5)}{4}$, $y \neq 0$, –3
(c) $\frac{1}{3}$, $a \neq 0$, $\frac{1}{2}$, –4
(d) $4x$, $x \neq -2$
(e) $\frac{b(b+4)}{3(b-1)}$, $b \neq -4, \pm 1$
(f) $\frac{3s+1}{3s(s+1)}$, $s \neq -1, 0, \frac{1}{2}$
4. (a) $\frac{8}{3y}$, $y \neq 0, 3$
(b) $\frac{4}{5}$, $p \neq -1, 2$
(c) $\frac{x+y}{x+4}$, $x \neq \pm 4$, y
5. (a) $\frac{1}{k}$, $k \neq 0, \pm 1$
(b) $(x-3)(x+2)$, $x \neq \pm 3, 2$
(c) $\frac{2q-1}{1+3q}, q \neq \pm\frac{1}{2}, \pm\frac{1}{3}$
6. When you divide two rational expressions, take reciprocal of second expression so numerator of second expression is now the denominator. This new denominator cannot be zero so there may be additional restrictions to state.
7. (d) $\frac{(x+4)(x+5)}{(x-4)(x-5)}, x \neq 4, \pm 5$
8. (b) $\frac{(x+5)(x-3)}{x(x+1)}$, $x \neq \pm 1, 3, 0$
9. (a) $\frac{x+1}{x+3}, x \neq 1, -3$
(e) 1, $a \neq -5, 3, 2$
(f) $\frac{9+3p}{8p-4p^2}$, $p \neq -4, -3, 0, 2, 7$
10. (a) $\frac{x}{2}$, $x \neq -3, 2, 5$
(b) 1, $k \neq -5, 2, \pm 4$
12. (a) 0.5 billion dollars
(b) 5 billion dollars
(c) 50 billion dollars
14. (a) $\frac{a+b}{-a^2-b^2}$, $a \neq 0, \pm b$
(b) x, $x \neq 0, \pm 1, 2, 3, -4$
16. $f(x) = 3g(x)$
17. (a) $\frac{(x-2)(3x+2)}{(2x-1)(x+1)}, x \neq \pm\frac{2}{3}, \pm\frac{1}{2}, \pm 1$
(b) $\frac{(3a+b)(2a-1)}{(a+5b)(2a+1)}, a \neq \frac{b}{4}, -5b, \pm\frac{3}{2}b, \pm\frac{1}{2}$
(c) $\frac{m(m+2n)}{(m+n)(4m+n)}, m \neq -\frac{3}{2}n, -\frac{1}{3}n, \pm n, \pm 2n, -\frac{1}{4}n$

Practise, Apply, Solve 4.10U, page 362

2. (a) $\frac{1}{2} - \frac{1}{2}i$
(f) $\frac{x}{x^2+y^2} - \frac{y}{x^2+y^2}i, x, y \neq 0$
3. (b) $1 + i$

Practise, Apply, Solve 4.11, page 369

2. (a) $\frac{2b+7a}{ab}, a, b \neq 0$
9. (d) $\frac{9q^2-4q-4}{6(4q+3)(3q-2)(q-2)}, q \neq -\frac{3}{4}, \frac{2}{3}, 2$
10. (a) $x = -\frac{2}{3} + \frac{\sqrt{2}}{3}i$ or $x = -\frac{2}{3} - \frac{\sqrt{2}}{3}i$
12. Arshia's speed: 8.4 km/h; Sarah's speed: 8 km/h; Arshia's time: 5 h; Sarah's time: 5.25 h

13. 5 km/h
14. 6 km/h
15. 18 shirts

Practise, Apply, Solve 4.12, page 374

5. (a) $x^3 + x^2 - 4x - 4$
(c) $x^4 - 3x^3 + 6x^2 - 3x + 5$
7. (f) $6x^3 + x^2 - 16x + 5$
8. (a) $-x^2 + 2x + 12$

Chapter 4, Review and Practice, page 378

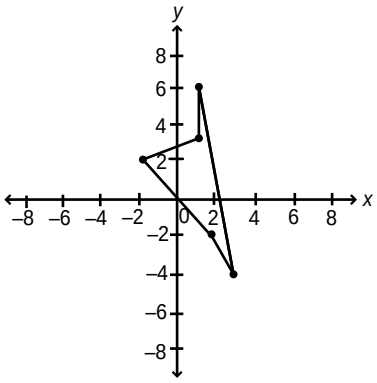
8. (b) min, $x = -2, -25$
(c) max, $t = 2, 20$
(d) max, $x = 0.55, -0.702\ 25$
9. (b) $P(x) = -5x^2 + 20x - 15$
(c) $x = 2$
(d) 1000 and 3000
(e) $P(x) = -5(x - 2)^2 + 5$; parabola, opens down; vertex (2, 5), zeros: 1, 3, y-int: –15
19. (d) Q, R, C
(g) Q, R, C
(h) Q, R, C
(i) W, R, C, I, Q
24. (f) $-5 - 3i$
(i) $50 - 14i$
25. (a) 6; $-2i$; 10
(b) 6; $8i$; 25
(c) –10; $4i$; 29
33. (b) For $f(x)$, D = $\{x \mid x \in \mathbf{R}\}$, R = $\{y \mid y \geq -3, y \in \mathbf{R}\}$
For $\frac{1}{f(x)}$, D = $\{x \mid x \neq \pm 1.7, x \in \mathbf{R}\}$,
R = $\{y \mid y \leq -\frac{1}{3}$ or $y > 0, y \in \mathbf{R}\}$
For $f^{-1}(x)$, D = $\{x \mid x \geq -3, x \in \mathbf{R}\}$, R = $y \in \mathbf{R}$
(c) For $f(x)$, D = $\{x \mid x \geq 2, x \in \mathbf{R}\}$, R = $\{y \mid y \geq -3, y \in \mathbf{R}\}$
For $\frac{1}{f(x)}$, D = $\{x \mid x \geq 2, x \neq 11, x \in \mathbf{R}\}$,
R = $\{y \mid y \neq 0, y \in \mathbf{R}\}$
For $f^{-1}(x)$, D = $\{x \mid x \geq -3, x \in \mathbf{R}\}$, R = $\{y \mid y \geq 2, y \in \mathbf{R}\}$
42. (g) $-\frac{2(x+3)}{(x-3)}, x \neq 0, 2, 3$
46. (c) $\sqrt{2} + \sqrt{2}i, \frac{1}{\sqrt{2} - \sqrt{2}i}, \frac{\sqrt{2}}{4} + \frac{\sqrt{2}}{4}i$
(d) $-3 - \sqrt{3}i, \frac{1}{-3 + \sqrt{3}i}, -\frac{3}{12} - \frac{\sqrt{3}}{12}i$
52. (j) $-\frac{6b}{(a+b)(a-b)}, a \neq 0, \pm b, b \neq 0$
54. (c) $x = \pm\frac{1}{\sqrt{3}}, 0$

Chapter 4 Review Test, page 387

1. (a) $-1 + i$, $-5 + 3i$, 13, $-\frac{4}{5} + \frac{1}{10}i$
2. (c) $\frac{3b}{a}, a \neq 0, \pm b, -3b$
5. (b) $1 + 2i$; $x^2 - 2x + 5 = 0$
8. (a) 18.2 mg
(b) 54.6 mg

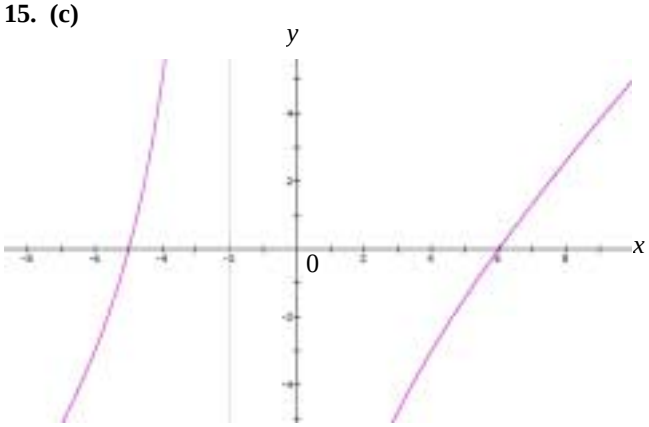
Cumulative Review Test 2, page 389

5. (a)



7. (b) $g^{-1}(x) = \frac{x^2 - 8}{4}$, $g(x)$: upper branch of parabola opens right, vertex (–2, 0), y-int: 2.87; $g^{-1}(x)$: parabola opens up; vertex (0, –2); zero at 2.87,
D of $g(x) = \{x \mid x \geq -2, x \in \mathbf{R}\}$,
R of $g(x) = \{y \mid y > 0, y \in \mathbf{R}\}$;
D of $g^{-1}(x) = x \in \mathbf{R}$, R of $g^{-1}(x) = \{y \mid y \geq -2, y \in \mathbf{R}\}$
9. (a) $x \rightarrow \boxed{-2} \rightarrow \boxed{\times\frac{1}{2}} \rightarrow \boxed{f} \rightarrow \boxed{\times\frac{1}{2}} \rightarrow \boxed{-1} \rightarrow y$
10. (e) parabola opens down, vertex (3, 24), zeros at 0.6 and 5.45, y-int: –12
14. (b) D of $f(x) = x \in \mathbf{R}$, R of $f(x) = \{y \mid y \geq -9, y \in \mathbf{R}\}$
(c) D of $f(x) = \{x \mid x \geq -3, x \in \mathbf{R}\}$,
R of $f(x) = \{y \mid y \geq -5, y \in \mathbf{R}\}$;
D of $\frac{1}{f(x)} = \{x \mid x \neq 22, x \in \mathbf{R}\}$,
R of $\frac{1}{f(x)} = \{y \mid y \neq 0, y \in \mathbf{R}\}$;
D of $f^{-1}(x) = x \in \mathbf{R}$, R of $f^{-1}(x) = \{y \mid y \geq -3, y \in \mathbf{R}\}$

15. (c)



17. (a) $\frac{2}{x-2}, x \neq \pm 2$

(b) $\frac{-3p^3}{q}, q \neq 0$

(c) $\frac{2(5x-3)}{(x+1)}, x \neq -1, -\frac{3}{5}, \frac{3}{4}$

(d) $\frac{(a-5)(a+2)(a+4)}{(a-4)(a^2-5a-15)}, a \neq 4, -2.11, 7.11, -3$

18. (f) $351 + 54i$

Review of Essential Skills—Part 3

The Trigonometry of Right Triangles, page 399

5. (a) 12.5 cm

Chapter 5, Getting Ready, page 406

10. (d) maximum: (5, 0.5), minimum: none, zeros: 3, 7

Practise, Apply, Solve 5.1, page 413

2. (d) The sun rises in the same spot as the earth rotates, forming a self-replicating function.

9. (b) 28 min

10. (b) 4 min

Practise, Apply, Solve 5.2, page 422

8. (h) 169°

14. The point (–5, –9) forms a right triangle in quadrant III with horizontal side 5 and vertical side 9. The angle x, which is the related acute angle for θ, is linked to the sides 5 and 9 by the tangent ratios. Once the acute value is known, then θ = (180° + related acute angle) for a quadrant III angle θ.

Practise, Apply, Solve 5.3, page 433

3. (a) i

(b) ii

(c) iii

(d) iv

6. (b) 348°

25. (e) $y = \csc\theta$: D = $\{\theta \mid \theta = m°, m \in \mathbf{R}, \theta \neq 180°n, n \in \mathbf{I}\}$, R = $\{y \mid y \leq -1 \text{ or } y \geq 1, y \in \mathbf{R}\}$;
$y = \sec\theta$: D = $\{\theta \mid \theta = m°, \theta \neq 90° + 180°n, m \in \mathbf{R}, n \in \mathbf{I}\}$; R = $\{y \mid y \leq -1 \text{ or } y > 1, y \in \mathbf{R}\}$;
$y = \cot\theta$: D = $\{\theta \mid \theta = m°, \theta \neq 180°n, m \in \mathbf{R}, n \in \mathbf{I}\}$; R = $y \in \mathbf{R}$

Practise, Apply, Solve 5.4, page 442

8. (a) $(\theta, f(\theta)) = (-2\pi, 1), \left(-\frac{7\pi}{4}, 0.7\right), \left(-\frac{6\pi}{4}, 0\right), \left(-\frac{5\pi}{4}, -0.7\right),$

$(-\pi, -1), \left(-\frac{3\pi}{4}, -0.7\right), \left(-\frac{2\pi}{4}, 0\right), \left(-\frac{\pi}{4}, 0.7\right), (0,1), \left(\frac{\pi}{4}, 0.7\right),$

$\left(\frac{2\pi}{4}, 0\right), \left(\frac{3\pi}{4}, -0.7\right), (\pi, -1), \left(\frac{5\pi}{4}, -0.7\right), \left(\frac{6\pi}{4}, 0\right), \left(\frac{7\pi}{4}, 0.7\right), (2\pi, 1)$

15. (d) The graph is periodic and sinusoidal. $y = \sin\theta$, $0 \leq \theta \leq 2\pi$

19. (c) (11.5, –1)

Practise, Apply, Solve 5.6, page 455

7. (c) –2, 1080°, –45°, 2

9. (c) zeros: π, min. at (0, –2), max at (2π, 2), axis of symmetry at $y = 0$

18. (a) axis of symmetry $y = 1$, min. (–195°, –2), (–15°, –2), (165°, –2), (345°, –2), max. (–285°, 4), (–105°, 4), (75°, 4), (255°, 4), passing through points (x, 1) where x = –330°, –240°, –150°, –60°, 30°, 120°, 210°, 300°

(b) axis of symmetry $y = -2$, min. (–315°, –7), (–195°, –7), (–75°, –7), (45°, –7), (165°, –7), (285°, –7), max.(–255°, 3), (–135°, 3), (–15°, 3), (105°, 3), (225°, 3), (345°, 3), passing through points (x, –2) where x = –345°, –285°, –225°, –165°, –105°, –45°, 15°, 75°, 135°, 195°, 255°, 315°

(d) axis of symmetry $y = -3$, min.(–345°, –3.5), max. (15°, –2.5), passing through (180°, –3) and (–180°, –3)

20. cos θ: stretched vertically by factor of 3, reflected in θ-axis, moved up one unit on the y-axis, horizontally shifted $\frac{\pi}{8}$ units right, period: 180°; sin θ: vertically stretched by factor of 3, reflected in θ-axis, moved up one unit on y-axis, period: 180°, horizontal phase shift of $\frac{\pi}{4}$ units right

22. (e) SHOULD BE 22. (f)

23. (f) Let x-axis represent the day of the year and y-axis represent the number of hours of daylight axis of symmetry $D(t) = 12$, min. (0, 8) and (355, 8) max. (182.5, 16)

24. (b) max.(172.6, 28°)

25. a: vertical stretch by factor of a, b: horizontal phase shift by b units; shift right for $b < 0$, shift left for $b > 0$

Practise, Apply, Solve 5.7, page 463

2. (a) min. (90°, –1) and (–90°, –1)

6. $d = 5$

7. $d = -9$

20. (a) $a = \left|\dfrac{\text{maximum} - \text{minimum}}{2}\right|$

Practise, Apply, Solve 5.8, page 474

6. (e) 36.9°, 216.9°

9. (b) 131.8°, 311.8°

Chapter 5, Review and Practice, page 485

4. (b) The first cycle starts at $t = 0$ s and ends at $t = 50$ s. The minimum of the graph is $h = 1.5$ m and its maximum is $h = 5$ m. Repeat the given relation starting at $t = 50$ s.

28. (c) $\left(\dfrac{\pi}{4}, 1\right)\left(\dfrac{3\pi}{4}, 0\right)$

31. (b) amplitude $= \left|\dfrac{\text{maximum} - \text{minimum}}{2}\right|$

Chapter 5 Review Test, page 491

9. (a) 95°, 455°

10. (e) $T(t) = -18.9\cos\dfrac{\pi}{6}t + 5.8$

(f) phase shift 6 units right

Practise, Apply, Solve 6.1, page 509

8. (c) ($\angle l$, f, $\angle F$) = (50°, 16.2 cm, 95°), (130°, 4.2 cm, 15°)

(e) ($\angle X$, $\angle Z$, z) = (56°, 86°, 18.3 cm), (124°, 18°, 5.7 cm)

9. ($\angle E$, $\angle F$, f) = (50°, 89°, 35.1 cm), (130°, 9°, 5.5 cm)

Practise, Apply, Solve 6.2, page 522

13. Plane Able will land first.

Practise, Apply, Solve 6.3, page 532

15. (a) $AB = 6\sqrt{3}$, $AD = 12$, $BC = 6$, $CD = 6\sqrt{2}$, $AC = 6\sqrt{3} + 6$

Cumulative Review Test 3, page 553

5. (b) period: 2π

(f) zero at 4.592 and 10.069

6. (c) 18 s

7. (c) $\theta = 37.86°, 322.14°$

(d) $x = 33.02°, 213.02°$

Review of Essential Skills- Part 4

Analytic Geometry: Lines and Line Segments, page 560

1. (a) $m = -\dfrac{1}{8}$

Practise, Apply, Solve 7.1U, page 574

1. (d) rectangle with a diagonal line leading from bottom left corner to a point just left of the opposite corner.

20. The locus of B is another circle with radius r also inside the first circle.

Practise, Apply, Solve 7.4U, page 509

16. (f) $D = \{x \mid -6 \le x \le 6, x \in \mathbf{R}\}$, $R = \{y \mid -2 \le y \le 2, y \in \mathbf{R}\}$

Practise, Apply, Solve 7.6, page 602

1. (f) focus $\left(0, \dfrac{1}{4}\right)$

2. (c) vertex: (0, –12), opens right

3. (d) $(y + 3)^2 = 2(x - 1)$, vertex: (1, –3)

7. (b) $x^2 = -8y$

15. $(y - 2)^2 = 4(x - 1)$

17. 8 m

Practise, Apply, Solve 7.9U, page 615

1. (d) y-int: $\pm\sqrt{12}, \pm 2\sqrt{3}$

4. (f) asymptotes: $y = \dfrac{1}{2}x + 4$ and $y = \dfrac{1}{2}x - 2$

Practise, Apply, Solve 7.10U, page 620

5. (b) $\dfrac{(x-1)^2}{\frac{1}{3}} - (y-2)^2 = 1$

8. (a) minor axis: 4

Practise, Apply, Solve 7.11, page 626

4. radius (7, –4)

20. vertex: (0, 0)

Chapter 7, Review and Practice, page 629

16. *y*-int: (0, –8), (0, 8)

27. (b) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$

34. (d) ellipse, $\frac{x^2}{16} + \frac{(y-3)^2}{8} = 1$, vertices (4, 3) and (–4, 3)

Chapter 7U Review Test, page 633

1. (c) ellipse, vertices: (3, 0), (–3, 0), (0, 3), (0, –3), foci: (0, 0)

(d) parabola opening to the right, vertices: (3, 0), foci: (2, 0), (–2, 0)

4. In the equation: $\frac{x^2}{b^2} - \frac{y^2}{a^2} = -1$, the transverse axis is vertical (along the *y*-axis).

Cumulative Review Test 4, page 635

10. (a) D = $\{x \mid x \leq 1, x \in \mathbf{R}\}$, R = $\{y \mid y \in \mathbf{R}\}$

15. (b) $|k| > 12$, $k = \pm 12$, $|k| < 12$

17. Insert "(b)" before "no zeros"

27. (a) $x = \frac{\pi}{3}, \frac{2\pi}{3}, 1.0, 2.1$

33. (h) $\frac{145}{122} - \frac{9}{122}i$