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CHAPTER 1 BASIC ARITHMETIC

1.1 Recurring Decimals

1. $0.\dot{1}, 0.\dot{2}, 0.\dot{3}, 0.\dot{4}$ 2. $0.\dot{7}$ 3. $1.\dot{5}$

1. $0.\dot{8}\dot{7}, 0.\dot{1}\dot{3}, 0.\dot{0}\dot{4}, 0.\dot{5}\dot{2}$	1. $0.\dot{2}\dot{9}, 0.\dot{0}\dot{1}$
2. $0.\dot{1}\dot{2}\dot{3}, 0.\dot{6}\dot{7}\dot{9}, 0.\dot{7}\dot{2}\dot{1}, 0.\dot{0}\dot{0}\dot{2}$	2. $0.\dot{2}\dot{2}\dot{7}, 0.\dot{0}\dot{0}\dot{5}$
3. $1.\dot{8}, 2.\dot{0}\dot{7}, 7.\dot{1}\dot{6}\dot{7}$	3. $3.\dot{8}, 1.\dot{7}\dot{7}, 19.\dot{8}\dot{7}\dot{1}$

4. (a) $\frac{5}{9}$ (b) $\frac{7}{90}$ (c) $1\frac{4}{9}$ (d) $1\frac{4}{45}$ (e) $1\frac{37}{300}$
5. $\frac{3}{11}$
6. (a) $\frac{34}{99}$ (b) $\frac{59}{99}$ (c) $1\frac{14}{99}$ (d) $\frac{242}{333}$ (e) $2\frac{43}{990}$
7. $\frac{213}{999}$
8. (a) $\frac{325}{999}$ (b) $\frac{146}{999}$ (c) $\frac{652}{999}$ (d) $1\frac{118}{333}$ (e) $2\frac{35}{999}$
9. Let the decimal equal x.
Multiply the decimal by 10 to the power of the number of recurring digits. That is, if the number of recurring digits is 2 then multiply by 10^2 or 100.
Subtract this new amount from the original decimal.
Only zeros should now recur and the decimal can be written as a fraction.

1.2 Zero and Negative Indices

1. (a) n^{-5} (b) x^{-4} (c) y^{-3} (d) a° (e) n^{-3}
(f) b^{-4} (g) x° (h) z^{-1} (i) p^{-1} (j) n^{-1}
2. (a) $\frac{1}{n^5}$ (b) $\frac{1}{x^4}$ (c) $\frac{1}{y^3}$ (d) 1 (e) $\frac{1}{n^3}$
(f) $\frac{1}{b^4}$ (g) 1 (h) $\frac{1}{z^1}$ (i) $\frac{1}{p^1}$ (j) $\frac{1}{n^1}$

$$x^{-n} = \frac{1}{x^n}$$

$$x^0 = 1$$

3. (a) $\frac{1}{x^2}$ (b) $\frac{5}{x^2}$ (c) $\frac{4}{x^3}$ (d) $\frac{1}{4x^2}$ (e) $\frac{3}{4a^3}$
4. (a) x^{-5} (b) $3x^{-2}$ (c) $\frac{2}{3}x^{-4}$
(d) $\frac{2}{5}x^{-4}$ (e) $\frac{1}{4}x^{-2}$

1.3 Fractional Indices

1. (a) 3 (b) 5 (c) 4 (d) 10 (e) x
(f) 4 (g) 9 (h) 16 (i) 49 (j) x
2. (a) 3 (b) 5 (c) 4 (d) 10 (e) x
(f) 4 (g) 9 (h) 16 (i) 49 (j) x
3. (a) 8 (b) 7 (c) x (d) 16 (e) 5 (f) 2
(g) 5 (h) x (i) 10 (j) x (k) 4 (l) 9
(m) 2 (n) 20 (o) x (p) 4 (q) 9
(r) 6 (s) 5 (t) x

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

$$x^{\frac{1}{n}} = \sqrt[n]{x}$$

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1.3 Fractional Indices (Cont.)

4. (a) 8 (b) 3 (c) 10 (d) 3
(e) 125 (f) 16 (g) 625 (h) 16

5. (a) $2x$ (b) $3m^3$ (c) $4x^2$
(d) $6x^6$ (e) $5x^2$ (f) $7a^2$
(g) $3a^{\frac{9}{4}}$ (h) $3m^{\frac{9}{5}}$

CHAPTER 2 ALGEBRA AND SURDS

2.1 Factorisation

1. C **2.** L **3.** G **4.** E **5.** O
6. H **7.** A **8.** D **9.** F **10.** N
11. I **12.** M **13.** K **14.** J
15. B **16.** R **17.** V **18.** S **19.** P
20. U **21.** W **22.** Q **23.** X **24.** T

2.2 Algebraic Fractions

1. (a) $b + 4$ (b) $x^2 - 2x$ (c) $\dfrac{2}{y+4}$
(d) $\dfrac{1}{x-3}$ (e) $\dfrac{a-2}{a-4}$ (f) $\dfrac{x+3}{4}$
(g) $\dfrac{4+y}{x^2+3x+9}$ (h) $\dfrac{x-4}{4x^2-2x+1}$

2. (a) $\dfrac{5a+9}{6}$ (b) $\dfrac{x+17}{12}$ (c) $\dfrac{11x+17}{15}$
(d) $\dfrac{-5a+9}{8}$ (e) $\dfrac{15-3x}{(x+3)(x-3)}$
(f) $\dfrac{7x-9}{(x+2)(x-2)}$

3. (a) $\dfrac{x(x+4)}{6}$ (b) $\dfrac{(a+5)(a-5)}{5ab}$
(c) $\dfrac{2x}{3(4+x)}$ (d) $\dfrac{x^2+2x+4}{4(x-2)}$
(e) $\dfrac{6x^2}{(x-1)(x^2+3x+9)}$ (f) $\dfrac{x-4}{10}$

2.3 Surds

1. (a) 10 (b) 5 (c) 2 (d) 8 (e) 1
(f) 0 (g) $\dfrac{1}{3}$ (h) $\dfrac{2}{5}$ (i) 20 (j) 0.2

2. (a) No (b) No (c) Yes (d) Yes

3. (a) Yes (b) Yes (c) Yes (d) Yes

4. (a) Yes (b) Yes (c) Yes (d) Yes

$$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$$

$$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$$

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2.4 Binomial Surds

1. (a) $\sqrt{6} + 5\sqrt{3}$ (b) $3\sqrt{10} - 4\sqrt{2}$
   (c) $6\sqrt{6} - 10\sqrt{3}$ (d) $8\sqrt{10} + 10$
   (e) $-\sqrt{6} + 4\sqrt{15}$ (f) $-6 + 12\sqrt{6}$
2. (a) $\sqrt{10} - 2 + \sqrt{15} - \sqrt{6}$
   (b) $5 - \sqrt{10} + 2\sqrt{15} - 2\sqrt{6}$
   (c) 3 (d) $9 + 2\sqrt{14}$ (e) 17
   (f) $9\sqrt{15} - 3\sqrt{6} + 3\sqrt{10} - 2$
   (g) $103 - 30\sqrt{14}$ (h) $44 + 16\sqrt{6}$
3. (a) $-3(2 + \sqrt{5})$ (b) $\dfrac{\sqrt{2}(\sqrt{3} - 4)}{-13}$
   (c) $\sqrt{2}(\sqrt{5} + \sqrt{2})$ (d) $5 + 2\sqrt{6}$
   (e) $\dfrac{4\sqrt{6} - 3\sqrt{3} - 20\sqrt{2} + 15}{23}$
   (f) $\dfrac{16\sqrt{6} - 8\sqrt{3} - 8\sqrt{2} + 4}{28}$

CHAPTER 3 EQUATIONS

3.1 Equations

1. (a) 2 (b) $x = 8$ or $x = -2$
2. (a) 1 (b) $x = 1\frac{3}{4}$
3. (a) 1 (b) $x = 3$
4. (a) 0 (b) No solution
5. (a) ∞ (b) $y > 2\frac{2}{3}$
6. (a) 1 (b) $x = -2$
7. (a) ∞ (b) Straight line
8. (a) ∞ (b) $-2 \leq n \leq \frac{4}{5}$
9. (a) 0 (b) No solution
10. (a) ∞ (b) $-3 < m < 3$
11. (a) 1 (b) $x = 3\frac{4}{7}$
12. (a) 2 (b) $x = \frac{4}{5}$ or $x = -\frac{2}{3}$
13. (a) 0 (b) No solution
14. (a) ∞ (b) $x < 0$ or $x \geq \frac{1}{2}$
15. (a) 2 (b) $x = 1$ or $x = -1$

3.2 Completing the Square

1. (a) $x^2 + 4x + 4$ (b) $x^2 - 6x + 9$
   (c) $x^2 + 10x + 25$ (d) $x^2 - 18x + 81$
   (e) $x^2 + 2x + 1$ (f) $x^2 - 8x + 16$
   (g) $x^2 + 24x + 144$ (h) $x^2 - 16x + 64$
   (i) $x^2 + 2xy + y^2$ (j) $x^2 - 2xy + y^2$
2. (a) $(x + 3)^2 = x^2 + 6x + 9$
   (b) $(x + 5)^2 = x^2 + 10x + 25$
   (c) $(x + 1)^2 = x^2 + 2x + 1$
   (d) $(x + 7)^2 = x^2 + 14x + 49$
   (e) $(x + 4)^2 = x^2 + 8x + 16$
   (f) $(x - 2)^2 = x^2 - 4x + 4$
   (g) $(x - 6)^2 = x^2 - 12x + 36$
   (h) $(x - 11)^2 = x^2 - 22x + 121$
   (i) $(x - 8)^2 = x^2 - 16x + 64$
   (j) $(x - 13)^2 = x^2 - 26x + 169$

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3.2 Completing the Square (Cont.)

3. (a) $x^2 + 2x + 1 = (x + 1)^2$
(b) $x^2 + 10x + 25 = (x + 5)^2$
(c) $x^2 + 6x + 9 = (x + 3)^2$
(d) $x^2 + 18x + 81 = (x + 9)^2$
(e) $x^2 + 12x + 36 = (x + 6)^2$
(f) $x^2 - 4x + 4 = (x - 2)^2$
(g) $x^2 - 8x + 16 = (x - 4)^2$
(h) $x^2 - 18x + 81 = (x - 9)^2$
(i) $x^2 - 14x + 49 = (x - 7)^2$
(j) $x^2 - 2x + 1 = (x - 1)^2$

4. (a) $x = \pm\sqrt{2} - 2$
(b) $x = \pm\sqrt{6} - 1$
(c) $x = \pm\sqrt{6} + 3$
(d) $x = \pm\sqrt{23} + 5$
(e) $x = \pm\sqrt{17} - 4$
(f) $x = \pm\sqrt{43} - 6$
(g) $x = \pm\sqrt{5} + 1$
(h) $x = \pm\sqrt{14} - 3$
(i) $x = \pm\sqrt{46} + 7$
(j) $x = \pm\sqrt{85} - 9$

3.3 Absolute Value

1. (a) 1 (b) 9 (c) 1
2. (a) 7 (b) 7 (c) 24
3. (a) 13, −3 (b) 3, −4 (c) $\frac{2}{3}$
4. (a) 9, $-\frac{1}{3}$ (b) −5, $\frac{3}{5}$ (c) 7, $-\frac{3}{5}$
5. (a) It is necessary to check the solutions for the second equation as it doesn't have absolute value signs on both sides, forcing one side to be positive and not necessarily the other side.
(b) (i) 9, $-\frac{1}{3}$ (ii) No solution (iii) 7

6. (a) Solve four separate equations
$a + b = 8$
$-a + b = 8$
$a - b = 8$
$-a - b = 8$
And then check solutions.
(b) (i) 3, $-6\frac{1}{3}$ (ii) 3, $-\frac{1}{5}$

3.4 Quadratic Inequations

1. (a) $-3 < x < 2$ (b) $x < -4$ U $x > \frac{1}{2}$
(c) $x \leq -6$ U $x \geq \frac{2}{3}$ (d) $-3 \leq x \leq 4$
(e) $2 < x < 3$ (f) $x < -4$ U $x > -\frac{1}{2}$
(g) $-\frac{2}{5} \leq x \leq 5$ (h) $x \leq -\frac{2}{3}$ U $x \geq \frac{3}{2}$
(i) $x < -4$ U $x > 3$ (j) $-5 < x < \frac{3}{2}$

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3.5 Extension Inequalities (Ext 1)

1. $x < 0 \text{ U } x > \frac{1}{2}$
2. $-\frac{1}{2} < x < -\frac{1}{4}$
3. $x < -5 \text{ U } x \geq -4\frac{1}{2}$
4. $3 < x \leq 3\frac{1}{2}$
5. $x < \frac{1}{2} \text{ U } x > 1\frac{1}{3}$
6. $x < -2 \text{ U } x > 2\frac{1}{2}$
7. $x < -6 \text{ U } x \geq -5\frac{1}{4}$
8. $-4\frac{6}{7} \leq x < -4$
9. $x < 1\frac{1}{2} \text{ U } x > 2\frac{1}{4}$
10. $\frac{1}{3} < x < 2$

CHAPTER 4 GEOMETRY 1

4.1 Geometric Proofs

1. $\angle ABE = x$ (alternate $\angle$s, $AC \parallel DG$)
   $\angle CBF = z$ (alternate $\angle$s, $AC \parallel DG$)
   $\therefore x + y + z = 180^\circ$ (ABC is a straight $\angle$)
2. $\angle BFG = 65^\circ$ (vertically opposite $\angle$s)
   $\therefore \angle BFG = \angle DGH = 65^\circ$
   $\therefore AB \parallel CD$ (equal corresponding $\angle$s)
3. $BC = DC$ (given)
   $\angle BAC = \angle CED$ (alternate $\angle$s, AB $\parallel$ DE)
   $\angle CDE = \angle ABC$ (alternate $\angle$s, AB $\parallel$ DE)
   $\therefore \Delta ABC \equiv \Delta DEC$ (AAS)
4. $\frac{AC}{CD} = \frac{15.98}{3.4} = 4.7$
   $\frac{BC}{CE} = \frac{9.87}{2.1} = 4.7$
   $\therefore \frac{AC}{CD} = \frac{BC}{CE}$
   $\angle ACB = \angle DCE$ (vertically opposite $\angle$s)
   $\therefore \Delta ABC \parallel\parallel \Delta DCE$ (2 pairs sides in prop, included $\angle$s equal)

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4.2 Congruent Figures

1. D **2.** A **3.** B

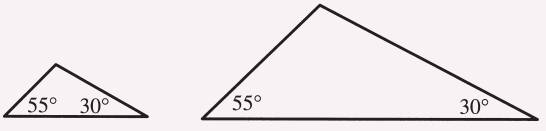
4.3 Congruent Triangles 1

1. (a) $AB = YZ, BC = XZ, AC = XY$
(b) $AB = YZ, AC = XZ, BC = XY$
(c) $AB = XY, AC = YZ, BC = XZ$

2. (a) $\angle A = \angle Y, \angle B = \angle X, \angle C = \angle Z$
(b) $\angle A = \angle Y, \angle B = \angle Z, \angle C = \angle X$
(c) $\angle A = \angle Z, \angle B = \angle Y, \angle C = \angle X$

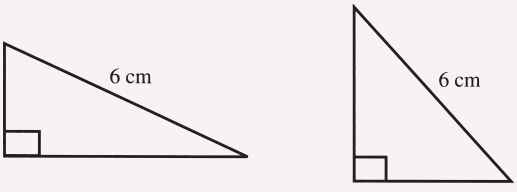
4.4 Congruent Triangles 2

1. Congruent
2. Non-congruent

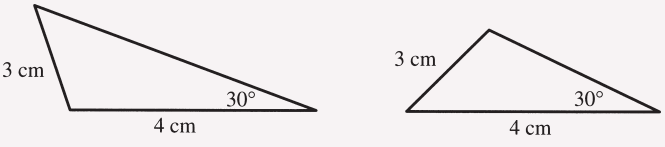


3. Non-congruent

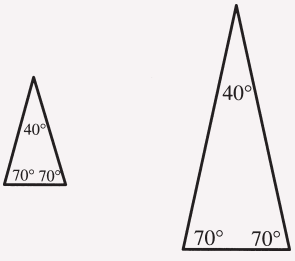
4. Congruent
5. Non-congruent



6. Congruent
7. Non-congruent



8. Congruent
9. Non-congruent



10. Congruent

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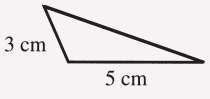
4.4 Congruent Triangles 2 (Cont.)

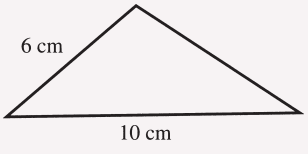
All diagrams could be drawn with triangles of different shapes and sizes except for the ones listed below. Hence the ones listed below show the 4 tests for congruent triangles

- Diagrams for 1 have to be congruent triangles and hence illustrates the SSS test for congruent triangles.
- Diagrams for 4 and 6 have to be congruent triangles and hence illustrates the AAS test for congruent triangles.
- Diagrams for 8 have to be congruent triangles and hence illustrates the SAS test for congruent triangles.
- Diagrams for 10 have to be congruent triangles and hence illustrates the RHS test for congruent triangles.

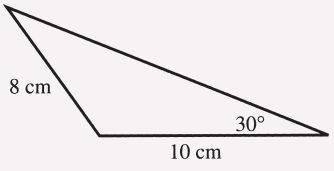
4.5 Similar Triangles

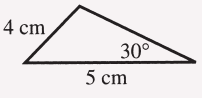
1. Similar
2. Similar
3. Similar
4. Non-similar





5. Similar
6. Non similar





All diagrams can be drawn with different shapes except the ones listed below. Hence there are 3 tests for similar triangles, as illustrated below.

- Diagrams for 1 and 2 have to be similar triangles (same shape, different size) and hence illustrate the test for similar triangles stating that 3 corresponding angles must be equal in size.
- Diagrams for 3 have to be similar triangles and hence illustrate the test for similar triangles stating that 3 corresponding sides must be in the same ratio.
- Diagrams for 5 have to be similar triangles and hence illustrate the test for similar triangles stating that 2 corresponding sides must be in the same ratio about an included equal angle.

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4.6 Polygons: Interior Angles

1. 3, 180°
2. (a) 4, 360°, 2 (b) 5, 540°, 3 (c) 6, 720°, 4
   (d) 8, 1080°, 6
3. (a) 3240°
   (b) 17 640°
4. $S = (n - 2) \times 180°$
5. $\angle A = \dfrac{(n - 2) \times 180°}{n}$

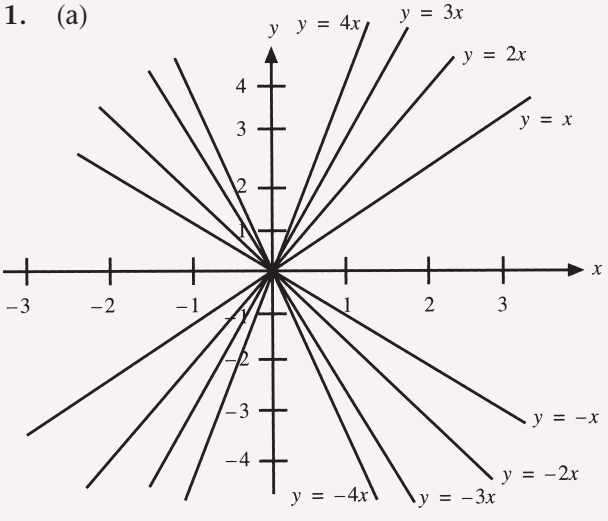
4.7 Polygons: Exterior angles

1. (a) 60° (b) 90° (c) 108°
   (d) 120° (e) 135°
2. (a) 120° (b) 90° (c) 72°
   (d) 60° (e) 45°
3. 360°, yes
4. (a) n (b) $S = 180n$ (c) 360°
5. $S = 360°$

CHAPTER 5 FUNCTIONS AND GRAPHS

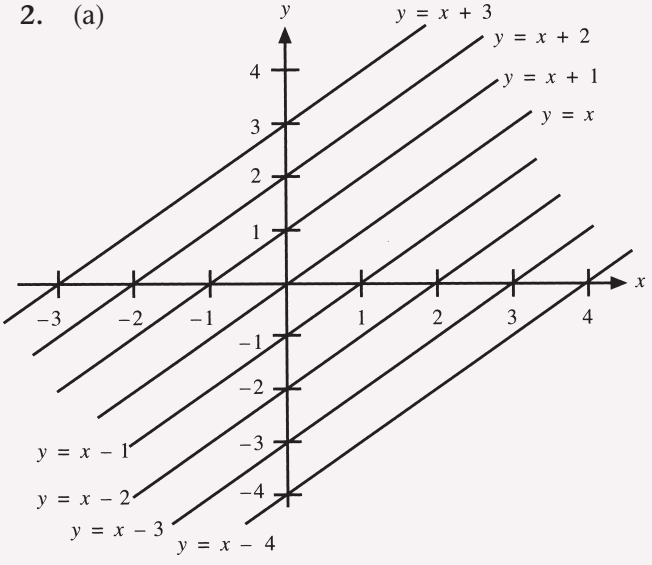
5.1 Exploring the Straight Line

1. (a)



(b) Class discussion

2. (a)



(b) Class discussion

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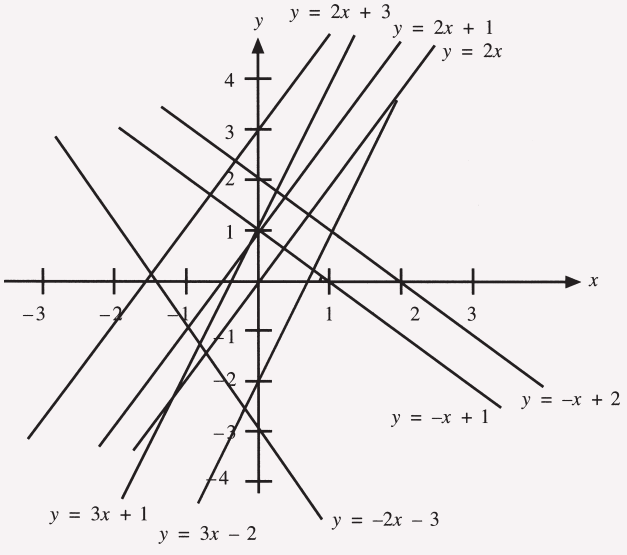
5.1 Exploring the Straight Line (Cont.)

3.

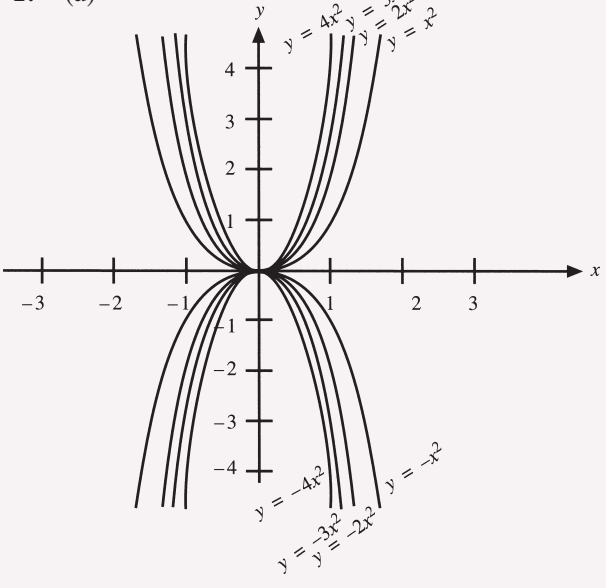


5.2 GeoGebra—Graphs

Student activity

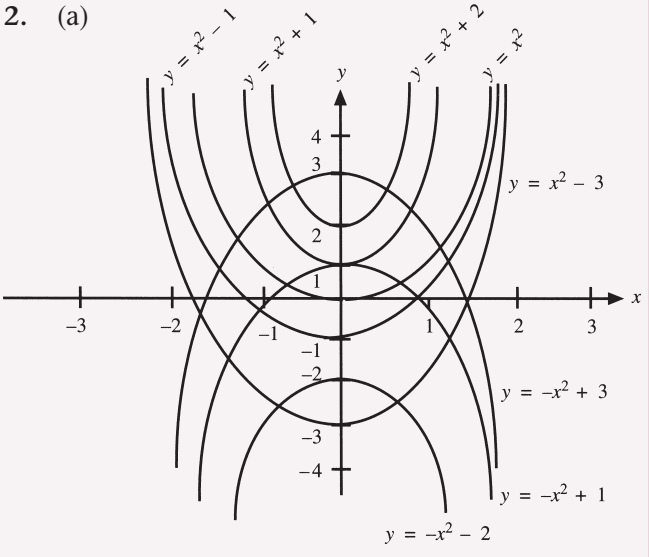
5.3 Exploring the Parabola

1. (a)



(b) Class discussion

2. (a)



(b) Class discussion

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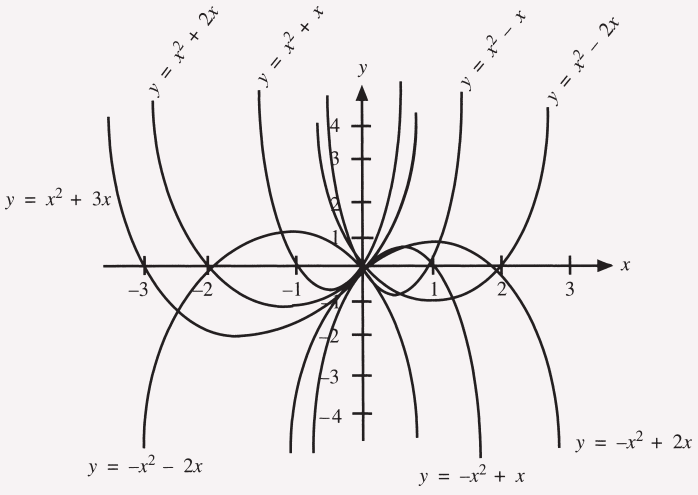
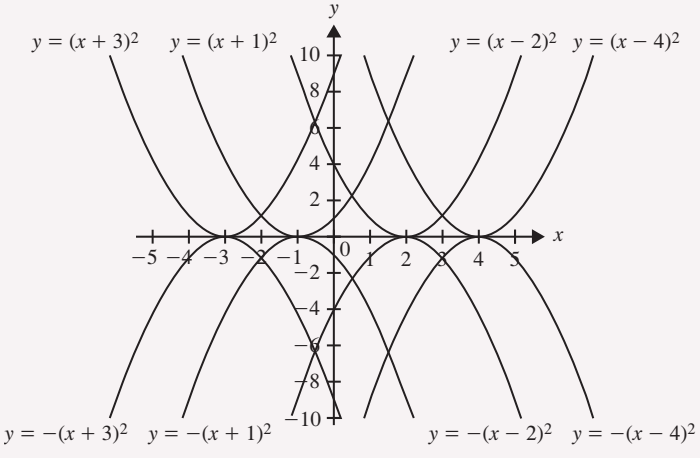
5.3 Exploring the Parabola (Cont.)

3. (a) Class discussion

(b)



4.



5.4 GeoGebra—Parabola

Student activity

5.5 Graph Matching

1. III E **2.** IV B **3.** IX D **4.** VII I **5.** I F **6.** VIII A **7.** VI D **8.** V G **9.** X C **10.** II H

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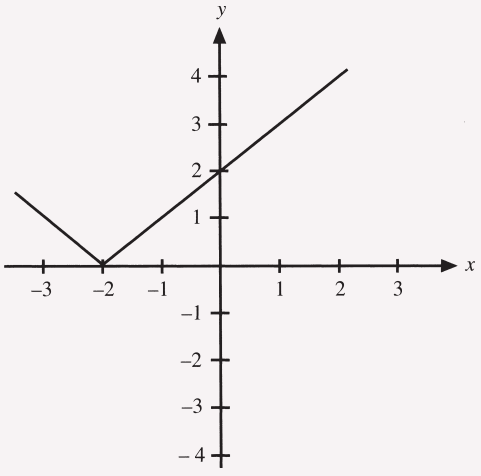
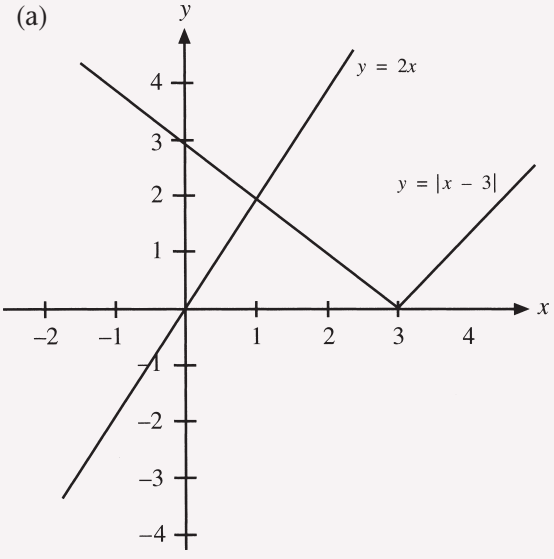
5.6 Absolute-Value Equations and Graphs

1. (a)



(b) $x = -5, 1$ (c) $x < -5, x > 1$

2. (a)



(b) $x = 1$

3. (a) $x = -5, -1$
(b) $x = 3, 5$
(c) $-5 < x < 3$
(d) $x \leq -\frac{1}{2}, x \geq 1\frac{1}{2}$

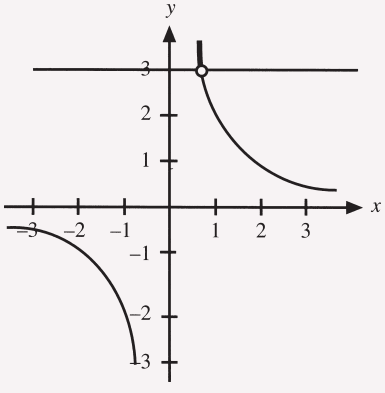
(e) $x = 1, -1\frac{1}{2}$
(f) $x = 0$
(g) $x = 1\frac{1}{2}$
(h) No solutions

5.7 GeoGebra—Absolute-Value Equations and Graphs

Student activity

5.8 Inequations and Graphs (Ext 1)

1. (a)

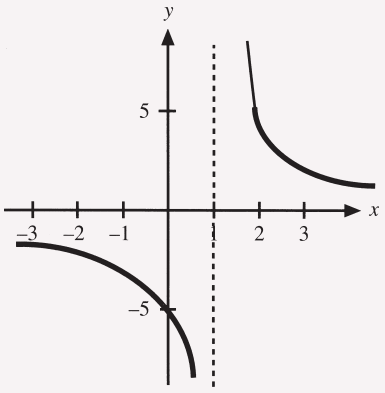


(b) $0 < x < \frac{1}{3}$

ANSWERS

5.8 Inequations and Graphs (Cont.)

2. (a)



(b) $x \geq 2, x < 1$

3. (a) $x < -3, x > -1$

(b) $x < 0, x \geq \frac{1}{2}$

(c) $x < 3, x \geq 5$

(d) $x < -9, x > -4$

(e) $3 < x \leq 5$

(f) $-1 < x < -\frac{1}{2}$

(g) $-1 < x < 0, 0 < x < 1$

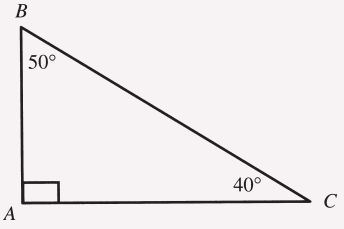
(h) $-2 \leq x < -1, \frac{1}{2} \leq x < 1$

CHAPTER 6 TRIGONOMETRY

6.1 Complementary Angles

1. (a) $\sin 50^\circ = \cos 40^\circ = 0.766$ (b) $\cos 50^\circ = \sin 40^\circ = 0.643$

(c)



$\sin 50^\circ = \frac{AC}{BC}$

$\cos 40^\circ = \frac{AC}{BC}$

So $\sin 50^\circ = \cos 40^\circ$

Similarly

$\cos 50^\circ = \sin 40^\circ = \frac{AB}{BC}$

2. (a) (i) $\sin\theta = \frac{3}{5}$

(ii) $\cos\theta = \frac{4}{5}$

(iii) $\tan\theta = \frac{3}{4}$

(iv) $\sec\theta = \frac{5}{4}$

(v) $\operatorname{cosec}\theta = \frac{5}{3}$

(vi) $\cot\theta = \frac{4}{3}$

(vii) $\sin(90^\circ - \theta) = \frac{4}{5}$

(viii) $\cos(90^\circ - \theta) = \frac{3}{5}$

(ix) $\tan(90^\circ - \theta) = \frac{4}{3}$

(x) $\sec(90^\circ - \theta) = \frac{5}{3}$

(xi) $\operatorname{cosec}(90^\circ - \theta) = \frac{5}{4}$

(xii) $\cot(90^\circ - \theta) = \frac{3}{4}$

(b) $\sin\theta = \cos(90^\circ - \theta)$ $\sec\theta = \operatorname{cosec}(90^\circ - \theta)$ $\tan\theta = \cot(90^\circ - \theta)$

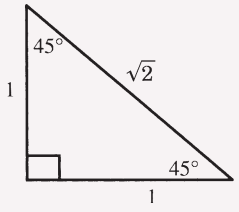
ANSWERS

6.1 Complementary Angles (Cont.)

3. (a) Answers will vary.
(b) Answers will vary.
(c) $90^\circ - \theta$
(d) Answers will vary.
(e) Answers will vary.

6.2 Exact Ratios

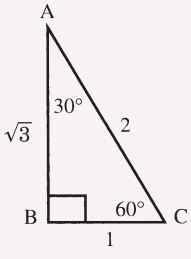
1. (a)



(b)

$\frac{1}{\sqrt{2}}$	$\sqrt{2}$
$\frac{1}{\sqrt{2}}$	$\sqrt{2}$
1	1

2.



(b)

$\frac{\sqrt{3}}{2}$	$\frac{2}{\sqrt{3}}$
$\frac{1}{2}$	2
$\sqrt{3}$	$\frac{1}{\sqrt{3}}$
$\frac{1}{2}$	2
$\frac{\sqrt{3}}{2}$	$\frac{2}{\sqrt{3}}$
$\frac{1}{\sqrt{3}}$	$\sqrt{3}$

3. $h = 5.5$ m

4. (a) $3\sqrt{3}$ cm
(b) $\frac{\sqrt{3}}{2}$
(c) $\frac{1}{\sqrt{3}}$

6.3 Angles of Any Magnitude 1

Class discussion

6.4 Angles of Any Magnitude 2

1. $\sin\theta = y$, $\cos\theta = x$, $\tan\theta = \frac{y}{x}$

2. (a) $\sin\theta = y$, $\cos\theta = -x$, $\tan\theta = \frac{-y}{x}$ (cos and tan are negative)
(b) $\alpha = 180^\circ - \theta$

ANSWERS

6.4 Angles of Any Magnitude 2 (Cont.)

3. (a) $\sin\theta = -y$, $\cos\theta = -x$, $\tan\theta = \dfrac{y}{x}$ (sin and cos are negative)

(b) $\alpha = 180^\circ + \theta$

4. (a) $\sin\theta = -y$, $\cos\theta = x$, $\tan\theta = \dfrac{-y}{x}$ (sin and tan are negative)

(b) $\alpha = 360^\circ - \theta$

5.

	Sign of the ratio			α *in terms*
	$\sin\theta$	$\cos\theta$	$\tan\theta$	*of* θ
First quadrant	+	+	+	θ
Second quadrant	+	−	−	$180^\circ - \theta$
Third quadrant	−	−	+	$180^\circ + \theta$
Fourth quadrant	−	+	−	$360^\circ - \theta$

6.5 Trigonometric Identities

1. (a) $\tan^2 x$ (b) $3\sin^2 x$ (c) 2 (d) 0 (e) 1 (f) 1 (g) $\tan^2 x \sec^2 x$ (h) $\sec^2 x$
(i) $\tan^2 x - \cot^2 x$ (j) $\cos x$

6.6 Variations on a Tower (Ext 1)

1. (a) 12.5 m (b) 22° 37′

(b) $\angle ACD = 90^\circ - 7^\circ = 83^\circ$

$$\tan 83^\circ = \frac{AD}{CD}$$

$\therefore CD \tan 83^\circ = AD$

$\angle DCB = 90^\circ - 9^\circ = 81^\circ$

$$\tan 81^\circ = \frac{BD}{CD}$$

$\therefore CD \tan 81^\circ = BD$

(c) 15.1 m

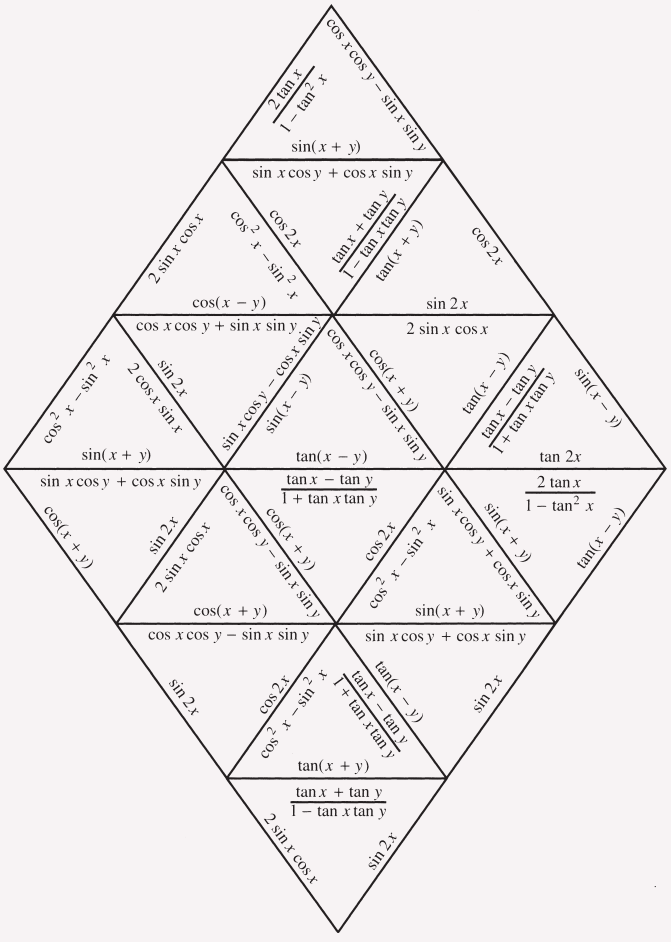
2. 198.2 m

3. 027°

4. (a) 133°

ANSWERS

6.7 Sums and Differences of Angles (Ext 1)



6.8 Trigonometric Equations 1 (Ext 1)

1.	(a) $x = 60°, 300°$	(b) $x = \pm 60°$	(c) $x = 360n \pm 60°$
2.	(a) $x = 135°, 315°$	(b) $x = -45°, 135°$	(c) $x = 180n - 45°$
3.	(a) $x = 60°, 120°, 240°, 300°$	(b) $x = \pm 60°, \pm 120°$	(c) $x = 180n \pm 60°$
4.	(a) $x = 15°, 105°, 195°, 285°$	(b) $x = 15°, 105°, -75°, -165°$	(c) $x = 90n + 15°$
5.	(a) $x = 90°, 270°$	(b) $x = \pm 90°$	(c) $x = 360n \pm 90°$
6.	(a) $x = 135°, 315°$	(b) $x = -45°, 135°$	(c) $x = 180n - 45°$
7.	(a) $x = 30°, 210°$	(b) $x = 30°, -150°$	(c) $x = 180n + 30°$
8.	(a) $x = 0°, 30°, 150°, 180°, 360°$	(b) $x = 0°, 30°, 150°, \pm 180°$	(c) $x = 180n, 180n + (-1)^n 30°$
9.	(a) $x = 0°, 60°, 300°, 360°$	(b) $x = 0, \pm 60°$	(c) $x = 360n, 360n \pm 60°$
10.	(a) $x = 120°, 240°$	(b) $x = \pm 120°$	(c) $x = 360n \pm 120°$

ANSWERS

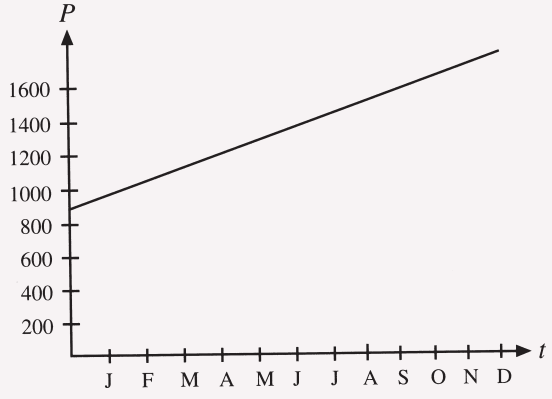
6.8 Trigonometric Equations 1 (Ext 1) (Cont.)

11. (a) $x = 69^\circ 12', 327^\circ 40'$ (b) $x = 69^\circ 12', -32^\circ 20'$ (c) $x = 180n + (-1)^n 39^\circ 14' - 71^\circ 34'$
12. (a) $x = 90^\circ, 216^\circ 52'$ (b) $x = 90^\circ, -143^\circ 8'$ (c) $x = 180n + (-1)^n 26^\circ 34' + 63^\circ 26'$
13. (a) $x = 180^\circ, 300^\circ$ (b) $x = -60^\circ, \pm 180^\circ$ (c) $x = 180n - (-1)^n 30^\circ - 30^\circ$
14. (a) $x = 105^\circ, 345^\circ$ (b) $x = 105^\circ, -15^\circ$ (c) $x = 180n + (-1)^n 30^\circ - 45^\circ$
15. (a) $x = 60^\circ$ (b) $x = 60^\circ$ (c) $x = 180n + (-1)^n 90^\circ - 30^\circ$

CHAPTER 7 LINEAR FUNCTIONS

7.1 Gradient

1. (a) 100 km/h (b) The car stopped
(c) 33.3 km/h (d) 66.7 km/h
2. (a) 10 litres (b) 2.5 litres/hour
3.



4. Gradient of line in Q2 is $\frac{20}{8} = \frac{5}{2}$
Gradient of line in Q3 is 100.
5. (a) 1 (b) -2 (c) -1 (d) $-\frac{2}{3}$ (e) $-\frac{3}{2}$
(f) $\frac{11}{3}$ (g) $-\frac{10}{12} = -\frac{5}{6}$ (h) 1 (i) -1
(j) $\frac{8}{6} = \frac{4}{3}$

7.2 Straight-Line Formulae

1. $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
2. (a) $m = \frac{y_2 - y_1}{x_2 - x_1}$
(b) $m = \tan\theta$
(c) m, where $y = mx + b$
3. (a) $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
(b) $d = \frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$
4. $y_2 - y_1 = m(x_2 - x_1); \frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$
5. (a) $m_1 = m_2$ (b) $m_1 m_2 = -1$
6. Solve simultaneous equations.
7. Collinear points lie on the same line. To prove A, B and C are collinear, show AB and BC have equal gradients.
8. Concurrent lines intersect at a single point. Solve two equations simultaneously to find the point, then substitute it into the other equations.
9. Find distance between each pair of points. Two distances are equal.

ANSWERS

7.2 Straight-Line Formulae (Cont.)

10. (i) Find lengths of three sides and show Pythagoras' rule is true.
(ii) Show that two gradients have $m_1 m_2 = -1$.

11. Given A, B and C, find midpoint of AC. It must be the midpoint of BD too.

12. Show both pairs of opposite sides have $m_1 = m_2$.

7.3 Perpendicular Distance

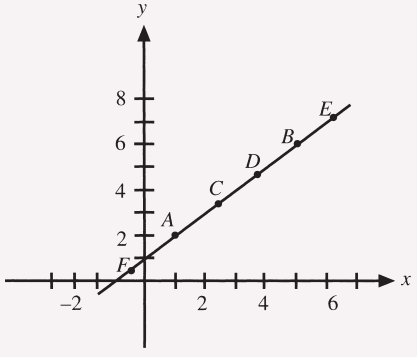
Answers are rationalised.

1. (a) $\sqrt{10}$ (b) $\frac{8\sqrt{13}}{13}$ (c) $-\frac{19}{5}$
(d) $\frac{8\sqrt{5}}{5}$ (e) $\frac{7\sqrt{10}}{5}$ (f) $\frac{4\sqrt{5}}{5}$

2. (a) A and B are on opposite sides of the line and C is on the line (as $d = 0$).
(b) E is on the opposite side of the line to D and F.
(c) G, H and I are all on the same side of the line.
(d) K is on the opposite side of the line to J and L.

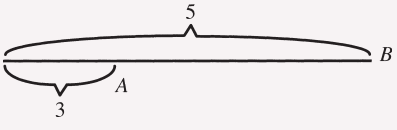
7.4 Ratios (Ext 1)

1. (a) $C = \left(2\frac{1}{3}, 3\frac{1}{3}\right)$ (b) $D = \left(3\frac{2}{3}, 4\frac{2}{3}\right)$
(c) $E = \left(6\frac{1}{3}, 7\frac{1}{3}\right)$ (d) $F = \left(-\frac{1}{3}, \frac{2}{3}\right)$
(e)



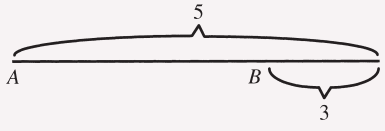
2. (a)

(b)



(c)

(d)



3. 2:1 **4.** 2:3 **5.** $x = 3, m = -4$

6. $m = 12$ and $y = 8\frac{1}{2}$ **7.** 4:3

8. When the ratio is 1:1 then

$$x = \frac{1x_1 + 1x_2}{1 + 1} \qquad y = \frac{1y_1 + 1y_2}{1 + 1}$$
$$= \frac{x_1 + x_2}{2} \qquad = \frac{y_1 + y_2}{2}$$

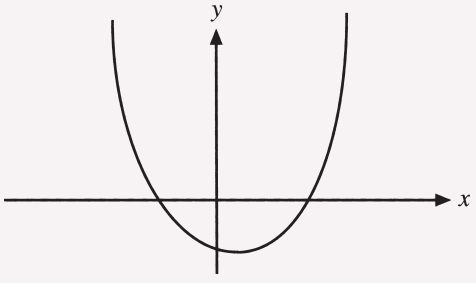
which is the midpoint formula.

ANSWERS

CHAPTER 8 INTRODUCTION TO CALCULUS

8.1 Gradient Functions

1.



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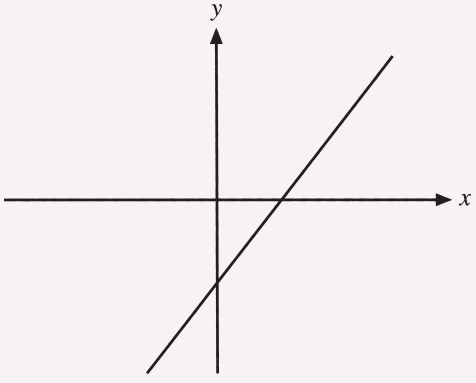

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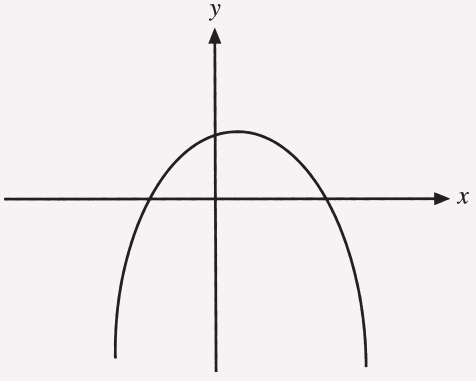

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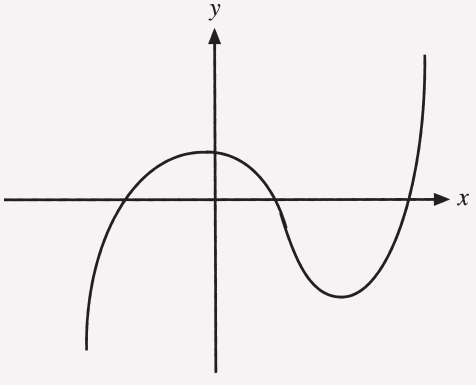
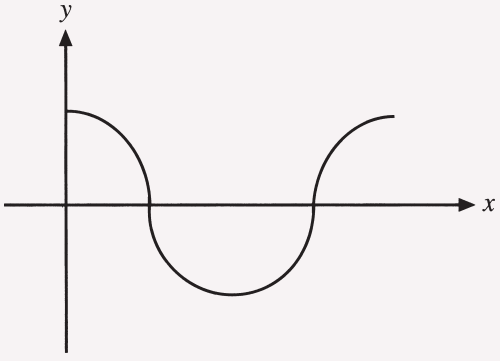


5.



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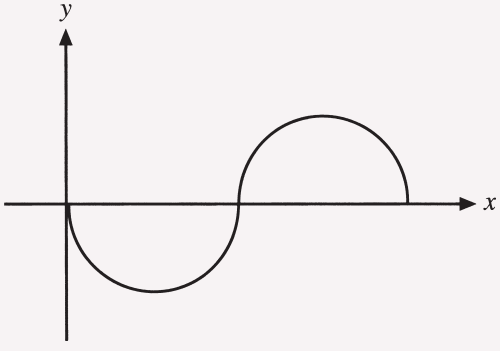

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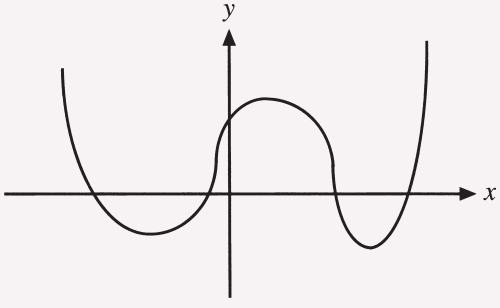
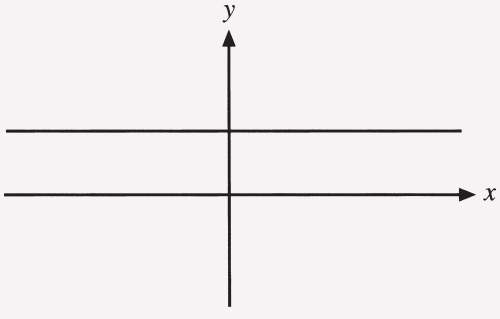


8.



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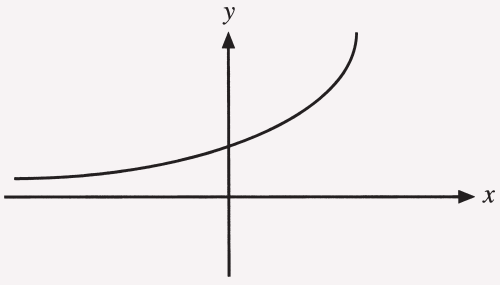
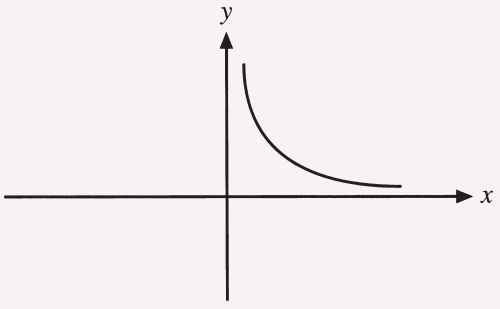
8.1 Gradient Functions (Cont.)

9.



10.



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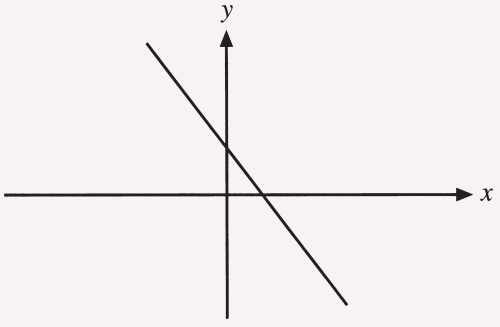

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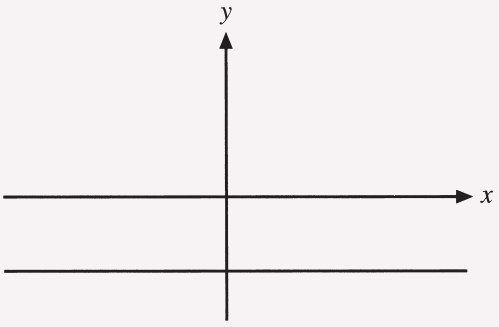
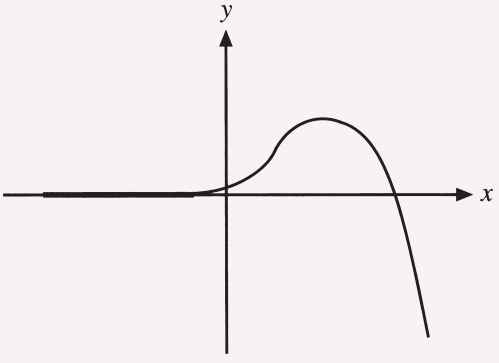
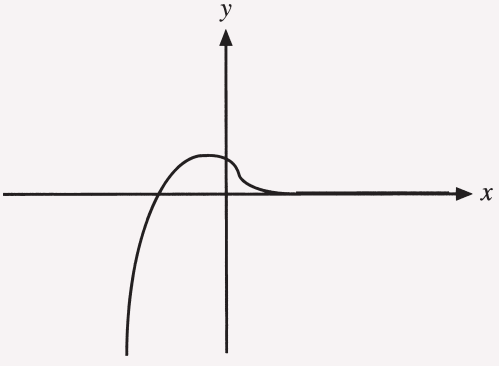


13.



14.



8.2 Differentiability

1. $x = 2$ 2. $x = 0$ 3. $x = 1, 3$ 4. $x = -3, 1, 4$ 5. $x = 2, 4$ 6. $x = 1$

8.3 First Principles

1. $2x$ 2. $6x$ 3. $4x$ 4. $2x - 2$ 5. $8x$ 6. 6 7. 8 8. -6

ANSWERS

8.4 Tangents and Normals

1. (a) 12 (b) 8 (c) 4 (d) 36
2. (a) $-\frac{1}{7}$ (b) $\frac{1}{9}$ (c) $\frac{1}{4}$ (d) 1
3. (a) $4x - y - 5 = 0$ (b) $4x - y + 2 = 0$
   (c) $10x + y + 7 = 0$ (d) $12x - y - 19 = 0$
4. (a) $x + 12y - 98 = 0$ (b) $x - 2y + 4 = 0$
   (c) $x - 5y + 8 = 0$ (d) $x + 5y - 6 = 0$
5. $(-1, 3)$
6. $x = 0, 1$
7. $\left(\frac{1}{\sqrt{3}}, \frac{1}{3\sqrt{3}}\right), \left(-\frac{1}{\sqrt{3}}, -\frac{1}{3\sqrt{3}}\right)$
8. $x = 2\frac{2}{3}$
9. $x = 2\frac{3}{4}$ 10. $(-1, 1)$

8.5 Consolidation of Differentiation

1. $12x^3 - 12x + x^{-\frac{1}{2}}$ 2. $12(3x - 5)^3$
3. $6(4x^2 + 6x - 3)$
4. $8(6x^3 - 5x^2)^3(9x^2 - 5x)$
5. $\frac{-26}{(3x - 4)^2}$ 6. $75x^4 + 60x^2$
7. $\frac{6x^2 - 24x - 8}{(2x - 4)^2}$ 8. $\frac{3(4x^2 + 1)}{2(4x^3 + 3x)^{\frac{1}{2}}}$
9. $(2x^3 + 5x)(2x - 4) + (x^2 - 4x)(6x^2 + 5)$
10. $\frac{-2(10x - 3)}{(5x^2 - 3x)^2}$
11. $8(4x + 2)^4(2x - 1)^2(8x - 1)$
12. $\frac{4(3x + 4)(3x - 13)}{(4x - 6)^2}$
13. $\frac{2(15x - 2)}{\sqrt{(6x + 2)(5x - 3)}}$
14. $\frac{4(3x^2 - x - 1)}{(4x + 1)^{\frac{3}{2}}}$

8.6 Angle Between Lines and Curves (Ext 1)

1. $m_1 = \tan\beta$ and $m_2 = \tan\alpha$
   $\beta = \alpha + \theta$ (exterior angle of triangle)
   $\therefore \theta = \beta - \alpha$
   $\tan\theta = \tan(\beta - \alpha)$
   $= \frac{\tan\beta - \tan\alpha}{1 + \tan\beta\tan\alpha}$
   $= \frac{m_1 - m_2}{1 + m_1 m_2}$
   For acute angles, $\tan\theta > 0$
   $\therefore \tan\theta = \left|\frac{m_1 - m_2}{1 + m_1 m_2}\right|$
2. $85^\circ 36'$
3. (a) 2 (b) 3 (c) $8^\circ 8'$
4. (a) $(-1, 2), (3, 6)$
   (b) $63^\circ 26'$ at $(-1, 2)$, $33^\circ 41'$ at $(3, 6)$
5. $63^\circ 26'$ at $(0, 0)$, $71^\circ 34'$ at $(-1, -1)$,
   $4^\circ 42'$ at $(2, 8)$

ANSWERS

CHAPTER 9 PROPERTIES OF THE CIRCLE

9.1 Circle Geometry Rules (Ext 1)

1. Equal
2. Centre
3. Twice
4. Segment
5. Semicircle
6. Perpendicular
7. Equal
8. $PT \times TQ = RT \times TS$
9. Supplementary
10. Interior opposite
11. Perpendicular
12. External
13. Contact
14. Alternate
15. $AB^2 = DB \times BC$

9.2 GeoGebra—Circle Geometry (Ext 1)

Student activity

9.3 Circle Geometry (Ext 1)

1. $a = 25^\circ$
2. $x = 33^\circ$
3. $c = 32^\circ$
4. $x = 93^\circ, ^\circ m = 76^\circ$
5. $x = 56^\circ, 28^\circ$
6. $a = 47^\circ, b = 23.5^\circ$
7. $x = 4.648$ cm
8. $a = 58^\circ, b = 116^\circ$

9.4 Mixed Circle Proofs (Ext 1)

1. (a) $\angle D$ is common

   $\angle ABD = \angle DAC$ ($\angle$s in alternate segment)
   $\angle BAD = \angle ACD$ ($\angle$ sum of triangle)
   So triangles ABD and ACD are similar (AAA)

   (b) $\therefore \dfrac{AD}{BD} = \dfrac{CD}{AD}$

   $AD^2 = CD \times BD$

2. Let $\angle BAE = x$ and $\angle EAC = y$.
   Then $\angle BAC = x + y$
   Also $\angle BCA = x + y$ (base $\angle s$ in isosceles triangle)
   $\angle BAE = \angle ADE = x$ ($\angle s$ in alternate segment)
   $\angle BCA = \angle ADE + \angle DAC$ (exterior $\angle$ in triangle)
   $x + y = x + \angle DAC$
   So $\angle DAC = y$
   $\therefore \angle DAC = \angle EAC$
   So AC bisects $\angle EAD$

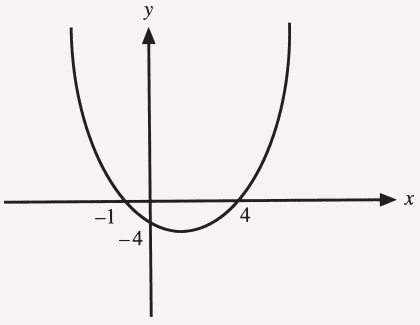
ANSWERS

CHAPTER 10 THE QUADRATIC FUNCTION

10.1 Quadratic Functions and Equations

1. (a) (i) $x = -1, 4$ (ii) 2

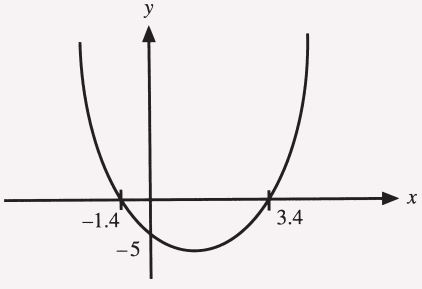
(iii)



(iv) 2

(b) (i) $x \doteqdot 3.4, -1.4$ (ii) 2

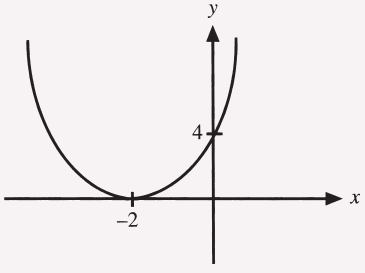
(iii)



(iv) 2

(c) (i) $x = -2$ (ii) 1

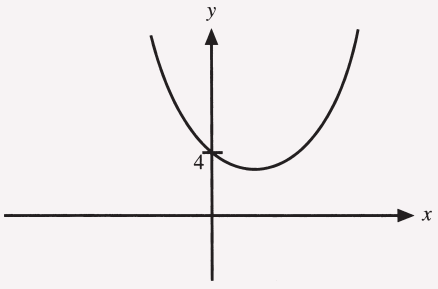
(iii)



(iv) 1

(d) (i) No solutions (ii) 0

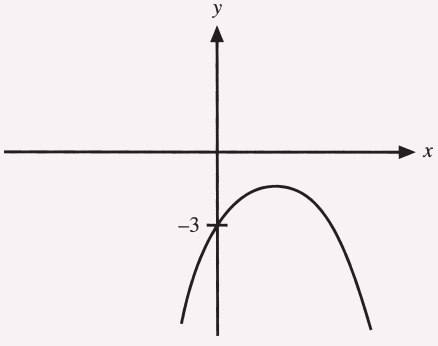
(iii)



(iv) 0

(e) (i) No solutions (ii) 0

(iii)



(iv) 0

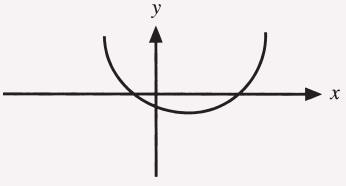
2. Class discussion

3. (a) $b^2 - 4ac > 0$ and is a perfect square.

(b) $b^2 - 4ac > 0$ and is not a perfect square.

(c) $b^2 - 4ac = 0$ (d) $b^2 - 4ac < 0$

4. (a)



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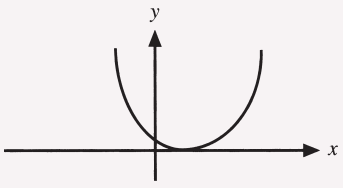
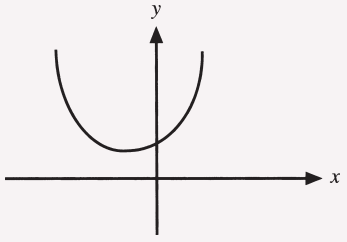
10.1 Quadratic Functions and Equations (Cont.)

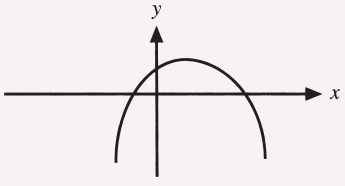
(b)



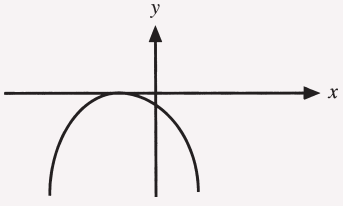
(c)



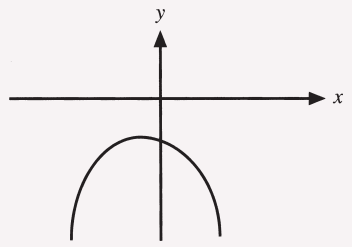
5. (a)



(b)



(c)



6. (a) real, rational, unequal
(b) real, irrational, unequal
(c) no real roots
(d) no real roots
(e) real, irrational, unequal
(f) real, irrational, unequal
(g) real, rational, equal
(h) real, rational, unequal
(i) real, rational, equal
(j) real, irrational, unequal

10.2 Quadratic Inequations

1. (a) $-3 < x < 2$
(b) $x < -4 \text{ U } x < \frac{1}{2}$
(c) $x \leq -6 \text{ U } x \geq \frac{2}{3}$
(d) $-3 \leq x \leq 4$
(e) $2 < x < 3$
(f) $x < -4 \text{ U } x > -\frac{1}{2}$
(g) $-\frac{2}{5} \leq x \leq 5$
(h) $x \leq -\frac{2}{3} \text{ U } x \geq \frac{3}{2}$
(i) $x < -4 \text{ U } x > 3$
(j) $-5 < x < \frac{3}{2}$

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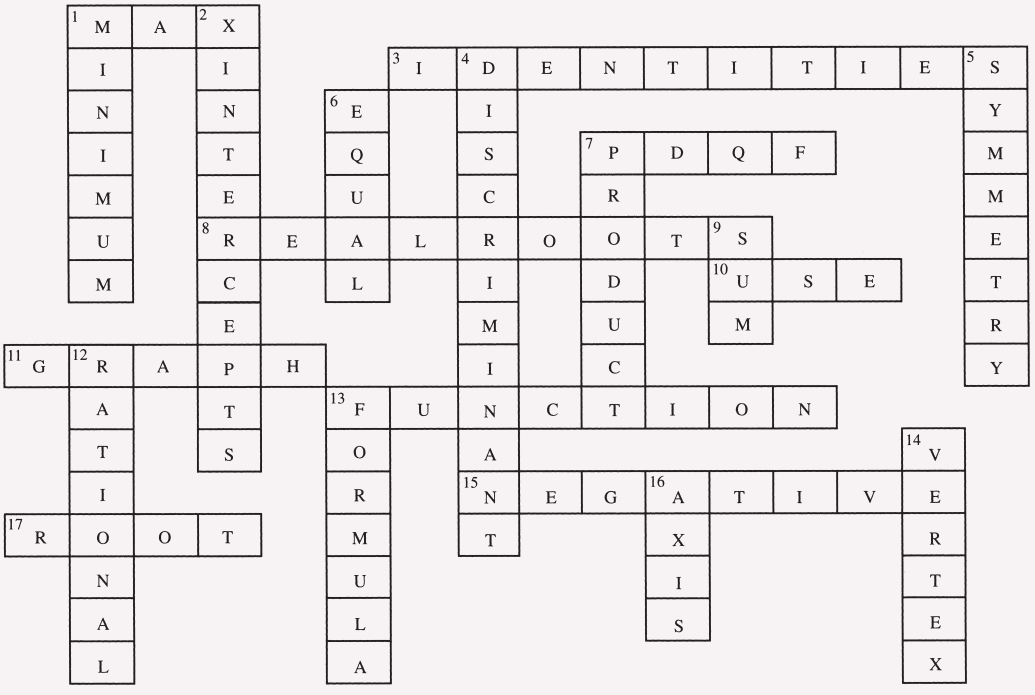
10.3 Quadratic Crossword



CHAPTER 11 LOCUS AND THE PARABOLA

11.1 General Locus and the Circle

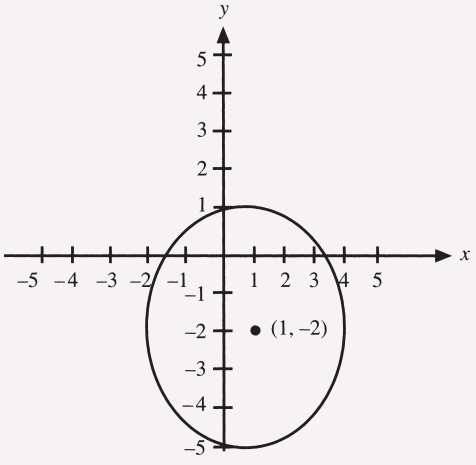
1. (a) $2x + 8y + 5 = 0$
   (b) $P = (1.5, -1), m = 4$
   (c) $2x + 8y + 5 = 0$
   (d) They are the same.
2. (a) $x^2 + 2x + y^2 - 6y - 10 = 0$
   (b) $C = (-1, 3)$
   (c) $\sqrt{20} = 2\sqrt{5}$ units
   (d) $x^2 + 2x + y^2 - 6y - 10 = 0$
   (e) They are the same.
   (f) The angle in a semicircle is a right angle.
3. $5x^2 + 22x + 5y^2 + 18y - 82 = 0$
4. $3x - 4y - 16 = 0, 3x - 4y + 14 = 0$
5. $x^2 - 2x + y^2 - 4y - 4 = 0$

ANSWERS

11.1 General Locus and the Circle (Cont.)

6. $x^2 + 4x + y^2 - 10y + 27 = 0$
7. (a) Centre $(2, 4)$, radius 5
   (b) Centre $(3, -1)$, radius 4
   (c) Centre $(-1, 5)$, radius 5
   (d) Centre $(-6, -2)$, radius 6

8.



11.2 Locus and the Parabola

1. $B(x, -4)$
   Locus: $16y = x^2 + 2x + 1$
2. $B(x, 2)$
   Locus: $12y = x^2 - 6x + 69$
3. $B(x, -3)$
   Locus: $4y = x^2 - 10x + 17$
4. $B(x, 4)$
   Locus: $4y = x^2 + 4x + 24$
5. $B(6, y)$
   Locus: $-8x = y^2 - 10y - 7$
6. $B(-5, y)$
   Locus: $4x = y^2 - 8y$

11.3 The Parabola

1. G **2.** M **3.** N
4. A **5.** O **6.** C
7. K **8.** D **9.** L
10. F **11.** E **12.** B
13. I **14.** J **15.** H

11.4 Parametric Equations (Ext 1)

1. (a) $y - px + ap^2 = 0$
   (b) $x + py = 2ap + ap^3$
   (c) $y - \frac{1}{2}(p + q)x + apq = 0$
   (d) q
   (e) $(a(p + q), apq)$
   (f) $(-apq(p + q), a(p^2 + pq + q^2 + 2))$
   (g) $pq = -1$
   (h) $-\frac{1}{q}$
   (i) $\frac{p + q}{2}$
   (j) $y = -a$

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11.4 Parametric Equations (Ext 1) (Cont.)

2. $x^2 = 2a(y - 4a)$
3. $x^2 = a(y - 3a)$
4. $71^\circ 34'$
5. (a) $4x - 3y + 6 = 0$
   (b) $R = (0, -18)$
   (c) $18^\circ 26'$
   (d) $FP = \sqrt{(12 - 0)^2 + (18 - 2)^2}$
   $= \sqrt{400}$
   $= 20$
   $FR = 2 - (-18) = 20$
   Since $FP = FR$, FRP is isosceles.
   $\therefore \angle FPR = \angle FRP$
   (base $\angle$s of isosceles triangle)

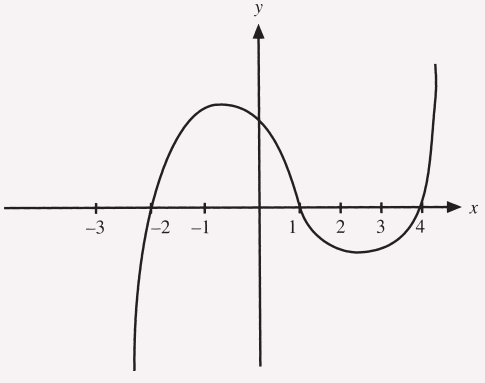
CHAPTER 12 POLYNOMIALS 1

12.1 Division of Polynomials (Ext 1)

1. (a) $6x^2 - 28x + 120$ remainder -474
   (b) $12x^2 + 30x + 94$ remainder 280
   (c) $8x^2 + 13x + 5$ remainder 9
   (d) $6x^3 + 8x^2 + 8x + 14$ remainder 32
   (e) $2x^3 - 16x^2 + 58x - 229$ remainder 924
2. (a) $3x^2 - 5x + 6$
   (b) $5x^2 - 2x - 4$
   (c) $2x^3 - 8x^2 + 3$

12.2 Graphs of Polynomials (Ext 1)

1. (a) $x = a, b, c$ (b) $a < x < b, x > c$
   (c) $b < x < c, x < a$
   (d) $p(x) = k(x - a)(x - b)(x - c)$
2. (a) $x = a, b, c$
   (b) $a < x < b, b < x < c$
   (c) $x < a, x > c$
3. (a) $x = -2, 1, 4$
   (b)



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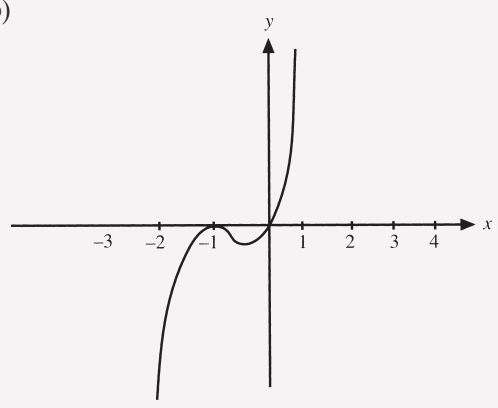
12.2 Graphs of Polynomials (Ext 1) (Cont.)

4. (a) $x = 0, -1$

(b)



12.3 Roots and Coefficients of Polynomial Equations (Ext 1)

1. (a) 2 (b) 4 (c) $\frac{5}{2}$

(d) 26.5 (e) 4 (f) $1\frac{3}{5}$

2. (a) 3 (b) 7 (c) 0 (d) $2\frac{1}{3}$

CHAPTER 13 PERMUTATIONS AND COMBINATIONS

13.1 Permutations and Combinations (Ext 1)

1. (a) ${}^{26}P_5$ (b) ${}^{12}C_2$ (c) ${}^{9}P_4$ (d) ${}^{5}C_3$
(e) ${}^{9}P_5$ (f) ${}^{6}P_3$ (g) ${}^{20}C_{11}$ (h) ${}^{8}P_4$
(i) 9! (j) 5!

2. (a) 7 893 600 (b) 66 (c) 3024 (d) 10
(e) 15 120 (f) 120 (g) 167 960
(h) 1680 (i) 362 880 (j) 120

13.2 Counting and Probability (Ext 1)

1. *kmd* **2.** $26^n \times 10^m$ **3.** $\frac{n!}{2!k!}$

4. (a) $n!$ (b) $2!(n-1)!$ (c) $5!(n-4)!$
(d) $(n-1)!$

5. (a) $(n-1)!$ (b) $2!(n-2)!$
(c) $5!(n-5)!$ (d) $(n-3)(n-2)!$

6. (a) $\frac{(n-1)!}{2}$ (b) $(n-2)!$ (c) $\frac{k!(n-k)!}{2}$

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13.2 Counting and Probability (Ext 1) (Cont.)

7. (a) $\binom{n}{p}$ (b) $\binom{n-1}{p-1}$ (c) $\binom{k}{b} \times \binom{n-k}{p-b}$

8. (a) ${}^{n}C_{t}\left(\frac{1}{p}\right)^{t}\left(\frac{p-1}{p}\right)^{n-t}$

(b) ${}^{n}C_{n-2}\left(\frac{1}{p}\right)^{n-2}\left(\frac{p-1}{p}\right)^{2} + {}^{n}C_{n-1}\left(\frac{1}{p}\right)^{n-1}\left(\frac{p-1}{p}\right)^{1} + {}^{n}C_{n}\left(\frac{1}{p}\right)^{n}$