ALGEBRA

EXERCISES 2(b)

Simplify the following expressions by collecting like terms.

1. $3x + 5 + 7x + 10$
2. $7x - 3 + 3x - 2$
3. $4a + b - a - 4b$
4. $6ab + 3ab + 5a + 4a$
5. $3xy + 2xy - yx$
6. $mn + 8mn - 3nm$
7. $3a^2b - 3ab^2 + 2a^2b$
8. $5xy^2 + 3xy^2 - 2xy$
9. $2x^2y + 3x^2y^2 - x^2y + 3x^2y^2$
10. $3abc + 5bca - 2cba$
11. $3p^2q - 5pq - 2p^2q$
12. $12mn + 3m - 6mn - m$
13. $x^2 - 3x + 2x + 4x^2$
14. $a^2 + 5a^2 - 3a - 5a$
15. $2x^2 + 5y^2 - 4x^2$
16. $9x^2 - 3xy + 5yx - 6x^2$

Simplify the following expressions by removing the brackets and collecting like terms.

17. $5a - 3(a + b)$
18. $4(2x - y) - 6x$
19. $8m - 5(2m - 3n)$
20. $3(2x + 5y) + 4(x - y)$
21. $5(2x + 3) - 5(x + 7)$
22. $6(2a + 3b) + 3(a - b)$
23. $7(2k + 1) - 3(k + 2)$
24. $5a(a + 2) - 3a(a + 1)$
25. $5x(x - 2y) + 3x(2x - y)$
26. $4a(2a + b) - a(a + 2b)$
27. $2a + 3b - (a - b)$
28. $x + 5y - (3x + 2y)$
29. $3x(x - y) + 2x(x - y)$
30. $5x(2x + 1) - (x^2 + x)$
31. $m(3m - 5n) + 3m(2m - n)$
32. $15(x - 2) + 4(3x - 3)$
33. $2(x^2 - x - 6) - 3(x^2 + 2x)$
34. $3x(x - 2) - 4(x - 1)$
35. $3(x^2 + 5x - 1) - (2x^2 + x - 2)$
36. $(5x + 2y - 3) - (x - 7y + 9)$
37. $a(a + 1) - 3(2a + 1)$
38. $3(m^2 - m) - 2(m^2 + 2m + 5)$

EXERCISES 2(d)

Write down the expansion of:

1. $(x + 5)(x + 1)$
2. $(x + 2)(x + 4)$
3. $(x - 2)(x - 3)$
4. $(a - 3)(a + 4)$
5. $(a + 5)(a - 4)$
6. $(p - 7)(p - 3)$
7. $(c + 4)(c - 5)$
8. $(x - 6)(x + 1)$
9. $(t + 5)(t - 1)$
10. $(x + 4)(x + 8)$
11. $(x + 4)(x - 8)$
12. $(x - 3)(x + 9)$
13. $(p - 5)^2$
14. $(x - 1)^2$
15. $(y + 7)^2$
16. $(2x + 3)(x + 5)$
17. $(3x - 4)(x - 2)$
18. $(3m + 7)(2m - 1)$
19. $(3y - 2)(4y + 3)$
20. $(6x - 7)(x - 4)$
21. $(5x - 3)(7x + 2)$
22. $(2m - 11)(3m - 4)$
23. $(y + 5)(3y - 2)$
24. $(5z - 14)(2z + 5)$
25. $(x - 14)(6x - 1)$
26. $(2p - 1)(4p + 3)$
27. $(3x + 2)(3x + 2)$
28. $(2p - 9)(2p + 9)$
29. $(3x + 2)(2x + 3)$
30. $(x + 1)(2x - 1)$
31. $(4p - 5)^2$
32. $(3x + 4)^2$
33. $(2a - 5)^2$
34. $(5y - 3)^2$
35. $(4y + 9)^2$
36. $(2x - 3)^2$
37. $(5p - 1)^2$
38. $(3p + 7)^2$
39. $(2z + 6)^2$

further extended.

EXERCISES 2(g)

Factorize each of the following and check your result by expanding your answer.

1. $a(x + 2) + b(x + 2)$
2. $x(p - 1) - 4(p - 1)$
3. $5a(p - 6) - 3(p - 6)$
4. $c(a - 3b) + d(a - 3b)$
5. $4x(x - y) + 5(x - y)$
6. $3a(2b - 3c) - m(2b - 3c)$
7. $p(a + b) + q(a + b) - r(a + b)$
8. $x(y + z) - y(y + z) - z(y + z)$
9. $x^2(2x - 1) + 4(2x - 1)$
10. $a(x + 2y) - b(x + 2y)$
11. $ax + ay + bx + by$
12. $ax + 4a + bx + 4b$
13. $x^2 - xy + xz - yz$
14. $2xy + 2xz + y + z$
15. $a^2 - ab - ac + bc$
16. $10y - 25y^2 + 4x - 10xy$
17. $a^3 + 3a^2b + ab^2 + 3b^3$
18. $ac - 2bc - 2ad + 4bd$
19. $ab + ax - 3b - 3x$
20. $3xy - 6y + 7x - 14$
21. $x^2 - 2xy - xz + 2yz$
22. $a^3 - a^2b - ab + b^2$
23. $3a - 3b + 2a^2 - 2ab$
24. $2mn + 2mp + pn^2 + p^2n$
25. $ay - 2a + y^2 - 2y$
26. $x^3 + 3x^2 + 4x + 12$
27. $2axc + 2c - axd - d$
28. $4ax + 6bx - 6a - 9b$
29. $p^2q - pq^2 + 5p - 5q$
30. $m^2p + m^2 + np + n$
31. $ax^2 - axy + bxy - by^2$
32. $2a^3 - a^2 + 2a - 1$
33. $2xy - xz - 8y + 4z$
34. $x^2y + x^2 + y + 1$
35. $ab - 3a - 4b + 12$
36. $2x - 6y - xy + 3y^2$
37. $a^3 + 3a^2b + ab^2 + 3b^3$
38. $3m^2 - 3mn - m + n$
39. $xw - yw + xy - y^2$
40. $2x^3 - 2x^2 + 2x - 2$

EXERCISES 2(f)

Factorize

1. $2a + 2b$
2. $20x - 5y$
3. $a + a^2$
4. $2x^2 - 6xy$
5. $m^2n + mn^2$
6. $r^2 - 2rs$
7. $5a^3 + 10a^2b$
8. $-15x - 10x^2$
9. $ab + ac + ad$
10. $px - py - pz$
11. $5a^2b^3 - 18a^3b^2$
12. $3a^2b + 6a^2b^2 + 9abc$
13. $8a^2b - 3a^2b^2$
14. $9m^3n^2 - 5m^2n^3$
15. $8p^2r^2q + 3p^2rq$
16. $9a^2b - 6ab^2$
17. $54x^2y^2 - 54x^3y^3$
18. $4a^2 + 4b^2 - 4c^2$
19. $mp + m^2p - mp^2$
20. $5a^2b - 5a^2b^2 - 5a^2b^3$

EXERCISES 2(h)

Factorize

1. $p^2 - q^2$
2. $m^2 - 1$
3. $x^2 - 16$
4. $64 - m^2$
5. $9a^2 - 25$
6. $x^2 - 0.36$
7. $a^2b^2 - c^2$
8. $p^2q^2 - r^2$
9. $9x^2 - 4y^2$
10. $\dfrac{a^2}{25} - 1$
11. $p^2 - \dfrac{1}{4}$
12. $36c^2 - 49d^2$
13. $(x + 1)^2 - 9$
14. $x^2 - y^2z^2$
15. $(2a)^2 - (3b)^2$
16. $\dfrac{x^2}{4} - \dfrac{1}{9}$
17. $(a + 2)^2 - 4$
18. $x^2 - (y + z)^2$
19. $99^2 - 1$
20. $523^2 - 477^2$
21. $a^3b - ab^3$
22. $12a^3 - 3ab^2$
23. $3x^2y - 27y$
24. $45a^2x - 20x$
25. $24x^2 - 54y^2$
26. $8a^2 - 2b^2$
27. $(x + y)^2 - 4$
28. $a^2 - (a - b)^2$
29. $a^3 - ab^2$
30. $2x^2 - 0.08$
31. $x^3 - x^2y - 9x + 9y$
32. $x^3 + 3x^2 - 4x - 12$
33. $p^2q - p^2 - 16q + 16$
34. $a^2x - x$
35. $48a^2 - 75b^2$
36. $\dfrac{x^2}{25} - y^2$
37. $3x^2y^2 - 12y^2$
38. $(1 + h)^2 - 1$
39. $z^3 - z$
40. $5 - 5x^2$
41. $\dfrac{a^2}{b^2} - \dfrac{b^2}{a^2}$
42. $m^2n - n^3$
43. $(p + 2)^2 - (p - 2)^2$
44. $64 - (9x)^2$
45. $2m^2n^2 - 18n^4$
46. $x^3 - 3x^2 - 9x + 27$
47. $8a^2x^2 - 18a^2y^2$
48. $a^3 + 2a^2 - ab^2 - 2b^2$

EXERCISES 2(j)

Factorize the following quadratic trinomials.

1. $x^2 + 4x + 3$
2. $x^2 + 10x + 21$
3. $x^2 + 11x + 24$
4. $x^2 + 6x + 5$
5. $a^2 + 7a + 6$
6. $a^2 + 12a + 32$
7. $m^2 + 9m + 20$
8. $p^2 + 9p + 18$
9. $p^2 + 11p + 18$
10. $p^2 + 19p + 18$
11. $x^2 + 7x + 12$
12. $x^2 + 13x + 12$
13. $x^2 + 8x + 12$
14. $x^2 - 7x + 12$
15. $x^2 - 13x + 12$
16. $x^2 - 8x + 12$
17. $m^2 - 9m + 20$
18. $m^2 - 12m + 20$
19. $m^2 - 21m + 20$
20. $x^2 - 14x + 13$
21. $p^2 + 2p - 15$
22. $p^2 - 2p - 15$
23. $p^2 + 14p - 15$
24. $p^2 - 14p - 15$

25. $x^2 - 2x - 35$
26. $x^2 - 3x - 10$
27. $x^2 + 17x + 72$
28. $a^2 - 4a - 12$
29. $x^2 - 7x + 6$
30. $x^2 - x - 72$
31. $x^2 + 6x - 72$
32. $x^2 - 21x - 72$
33. $a^2 + 13a + 30$
34. $x^2 - x - 42$
35. $x^2 - 19x - 42$
36. $x^2 + 19x - 42$
37. $x^2 - 11x - 42$
38. $x^2 + 6x - 7$
39. $y^2 + 6y - 55$
40. $y^2 - 6y - 55$
41. $x^2 + 14x + 33$
42. $x^2 - 14x + 33$

EXERCISES 2(k)

Factorize

1. $2x^2 + 3x + 1$
2. $3x^2 + 11x - 4$
3. $2x^2 + 7x + 6$
4. $4a^2 + 13a + 3$
5. $4x^2 + 5x + 1$
6. $3a^2 - 5a + 2$
7. $8x^2 - 14x + 3$
8. $2x^2 - 9x - 5$
9. $13c^2 - 7c - 6$
10. $8x^2 + 14x + 5$
11. $6x^2 + 17x + 12$
12. $3x^2 - 13x + 4$
13. $3x^2 - 17x + 10$
14. $6a^2 - 13a - 63$
15. $3x^2 - 11x - 4$
16. $10x^2 - 11x - 8$
17. $2x^2 + 3x - 2$
18. $4x^2 - 12x + 9$
19. $9x^2 - 12x + 4$
20. $2x^2 - 9x + 10$
21. $6x^2 - 85x + 14$
22. $15m^2 + 17m - 18$
23. $10a^2 - 41a - 18$
24. $2y^2 - 4y - 6$
25. $12y^2 + 14y - 6$
26. $6x^2 - 25x + 14$
27. $6x^2 - 29x + 28$
28. $6x^2 - 19x + 14$
29. $6x^2 - 20x + 14$
30. $8x^2 + 2x - 3$
31. $6p^2 + 25p + 21$
32. $10a^2 - 11a - 6$
33. $12y^2 + 28y - 5$
34. $24x^2 - 59x + 36$
35. $15x^2 - 19x + 6$
36. $3x^2 - 2x - 1$
37. $9x^2 + 9x - 10$
38. $2x^2 - 9x + 4$
39. $10p^2 + 11p + 3$
40. $5x^2 - 2x - 3$
41. $3p^2 - 7p + 2$
42. $8x^2 - 6x - 9$
43. $4x^2 + 12x + 9$
44. $9x^2 + 30x + 25$
45. $4x^2 - 28x + 49$

To factorize the expressions in the next set of exercises, it will be necessary to use *one or more* of the techniques we have studied:
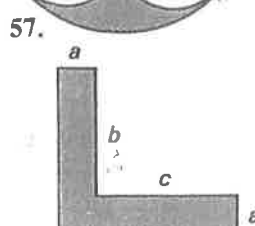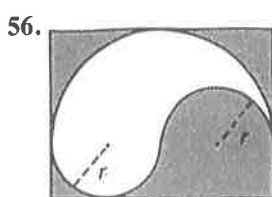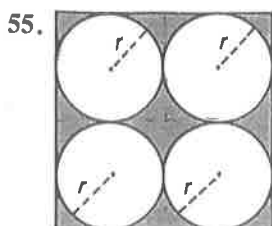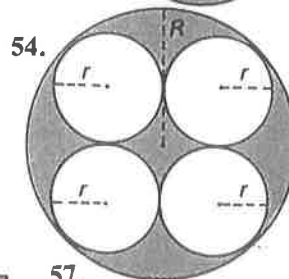
(i) something common in each term,
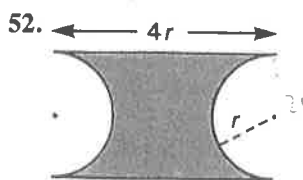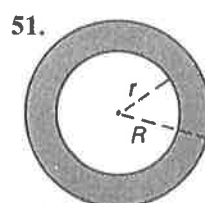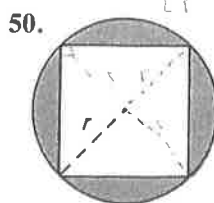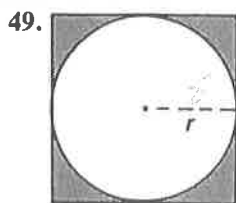(ii) grouping and using the Distributive Law in reverse,
(iii) difference of two squares,
(iv) sum and difference of two cubes,
(v) quadratic trinomials

EXERCISES 2(I)

Factorize completely

1. $x^2 - 3x$
2. $2a^3 - 8a$
3. $3x^2 + 9x$
4. $x^2 - 8x$
5. $x^2 - 9$
6. $x^2 - 8x - 9$
7. $3x^2y - 12y^3$
8. $5x^3y - 20xy^3$
9. $1 - (b - c)^2$
10. $10x^2 + 9x - 1$
11. $(a + b)^2 - b^2$
12. $6x^3 - 48$
13. $a^2 - a - 42$
14. $a(m + n) - b(m + n)$
15. $2x^3 + 14x^2 - 16x$
16. $3a^3 + 24a^2 + 21a$
17. $(x + 2y)^2 - 4$
18. $x^2 - 3x - 10$
19. $a^3 - 1$
20. $ab^2 + abc + abd$
21. $x^2 - 36y^2$
22. $x^2 + x$
23. $x^2 + x - 12$
24. $x(y - z) + y(y - z)$
25. $4x^2 - 28x - 480$
26. $bx^2 - 14bxy + 49by^2$
27. $6y^3 + 3y^2 - 3y$
28. $6y^3 + 26y^2 + 8y$
29. $15a^2 - 60$
30. $9mn - 25m^3n^3$
31. $5a^2x - 125x$
32. $(x + y)^2 - (x - y)^2$
33. $5t^3 + 5t^2 - 360t$
34. $x^2 - 12xy + 20y^2$
35. $5 - 125a^2$
36. $ax + bx + ay + by$
37. $m^2 - mn + 6m - 6n$
38. $(x + 3y)(x - 3y) - 3z(x + 3y)$
39. $x^2(x + 3) - 4(x + 3)$
40. $mx^2 - xy + ly - mlx$
41. $4 - (x + 1)^2$
42. $6x^3 - 34x^2 - 56x$
43. $x^2 - 2x + ax - 2a$
44. $x^2 - 10x - 144$
45. $2axc - axd + 2c - d$
46. $p^3 + 125$
47. $\dfrac{a^3}{8} - 1$
48. $(x + h)^3 + 1$

Write an algebraic expression in factorized form for the shaded area in each of the figures in questions **49.** to **57.**

49.

50.

51.

52. $\longleftarrow\ 4r\ \longrightarrow$

53.

54.

55.

56.

57.

EXERCISES 2(m)

Simplify

1. $\dfrac{8a - 4b}{4}$
2. $\dfrac{15x + 10y}{15}$
3. $\dfrac{14x - 7y}{2x - y}$
4. $\dfrac{8x^2 - 4xy}{8xy}$
5. $\dfrac{12ab - 6b^2}{9ab}$
6. $\dfrac{8x + 2}{4x + 1}$
7. $\dfrac{3a - 5b}{3a^2 - 5ab}$
8. $\dfrac{m + m^2}{m}$
9. $\dfrac{mn - n^2}{n}$
10. $\dfrac{p^2q - pq^2}{pq}$
11. $\dfrac{x^2 + xy}{2x}$
12. $\dfrac{2rs - 12r}{r^2 + rs}$
13. $\dfrac{x^2 - y^2}{(x + y)^2}$
14. $\dfrac{k^2 + k}{k + 1}$
15. $\dfrac{x^2 - 9}{x^2 + 3x}$
16. $\dfrac{15a^2 - 5ab}{3ab - b^2}$
17. $\dfrac{4x^2 - 4xy}{x^2 - y^2}$
18. $\dfrac{x^2 - 7x + 6}{x^2 - 36}$
19. $\dfrac{a^2 + ab}{ab + b^2}$
20. $\dfrac{a^2 - b^2}{a^2 + ab}$
21. $\dfrac{x^2 - 1}{x^2 - 5x + 4}$
22. $\dfrac{x^2 - 6x + 8}{x^2 - x - 2}$
23. $\dfrac{x^2 + 3x + 2}{x^2 - 4}$
24. $\dfrac{x^2 - 5x + 6}{x^2 + x - 12}$
25. $\dfrac{x^2 + 4x + 4}{x^2 - 3x - 10}$
26. $\dfrac{4x^3y - 16xy}{x^2 + 2x - 8}$
27. $\dfrac{m^2 + m - 2}{m^2 - m}$
28. $\dfrac{3x^2 - xy}{xy} \times \dfrac{x^2y}{3xy - y^2}$
29. $\dfrac{12a + 9}{15} \times \dfrac{5}{4a + 3}$
30. $\dfrac{2a^2 - 3ab}{ab - b^2} \times \dfrac{2a^2 - 2ab}{4a - 6b}$
31. $\dfrac{15x^2 - 5xy}{10xy} \div \dfrac{3x - y}{2y}$
32. $\dfrac{12x^2 - 4x}{3x^2 - x} \div \dfrac{10x^2y}{5x^2y^2}$
33. $\dfrac{x^2 - 2x - 3}{x^2 - 4x - 5} \times \dfrac{x^2 - 25}{(x - 3)(x + 5)}$
34. $\dfrac{(a + 2b)(a - b)}{a^2 - 4b^2} \times \dfrac{a^2 - 3ab + 2b^2}{ab - b^2}$
35. $\dfrac{m^2 - 9}{m^2 - m - 12} \div \dfrac{m^2 - 3m}{m^2 - 9m + 20}$
36. $\dfrac{x^3 + y^3}{x^2 - y^2}$
37. $\dfrac{8x^2 + 4x + 2}{8x^3 - 1}$
38. $\dfrac{2x + 2y}{x^3 - y^3} \times \dfrac{x^2 - 2xy + y^2}{x^2 - y^2}$
39. $\dfrac{(x + h)^3 - x^3}{h}$
40. $\dfrac{x^3 - (x - y)^3}{x^2 - (x - y)^2}$

EXERCISES 2(n)

Express each of the following as a single fraction.

1. $\dfrac{x}{5} - \dfrac{x}{6}$
2. $\dfrac{3x}{8} + \dfrac{x}{2}$
3. $\dfrac{a}{3} + \dfrac{4a}{5} - \dfrac{a}{6}$
4. $\dfrac{y}{2} + \dfrac{2y}{3} - \dfrac{y}{4}$
5. $\dfrac{a + 2}{5} - \dfrac{a - 1}{3}$
6. $\dfrac{2x - y}{3} - \dfrac{x - 3y}{6}$
7. $\dfrac{3x + 2}{6} - \dfrac{x + 1}{4}$
8. $\dfrac{3m - 2n}{5} + \dfrac{m + n}{10}$
9. $\dfrac{x}{2} + \dfrac{y}{4} - \dfrac{x + y}{3}$
10. $\dfrac{a - 2b}{6} - \dfrac{2a + b}{9}$
11. $\dfrac{3(a + b)}{4} - \dfrac{a - b}{6}$
12. $\dfrac{1}{x} - \dfrac{2}{3x}$
13. $\dfrac{3}{a} + \dfrac{1}{a^2}$
14. $\dfrac{1}{ab} - \dfrac{2}{b}$
15. $\dfrac{m}{n} - \dfrac{n}{m}$
16. $\dfrac{4}{xy} + \dfrac{3}{yz}$
17. $\dfrac{5}{a^2b} - \dfrac{2}{ab^2}$
18. $\dfrac{1}{ab} + \dfrac{a}{bc}$
19. $\dfrac{a + 1}{6a} + \dfrac{a - 4}{2a}$
20. $\dfrac{1}{x + 1} + \dfrac{2}{3}$
21. $\dfrac{1}{x} + \dfrac{2}{x} - \dfrac{1}{x^2}$

EXERCISES 2(o)

Express each of the following as a single fraction.

17. $\dfrac{1}{a - b} + \dfrac{1}{a + b}$
18. $\dfrac{3}{x - y} - \dfrac{2}{x + y}$
19. $\dfrac{x}{x - y} + \dfrac{y}{x - y}$
20. $\dfrac{x}{x - y} + \dfrac{y}{x + y}$
21. $\dfrac{3a - b}{a^2 - b^2} + \dfrac{1}{a - b}$
22. $\dfrac{1}{x^2 - 4} - \dfrac{1}{x + 2}$
23. $\dfrac{x}{x^2 - y^2} - \dfrac{y}{x^2 - y^2}$
24. $\dfrac{3}{(x - 2)^2} + \dfrac{2}{x - 2}$
25. $\dfrac{1}{x^2 - 4x + 3} - \dfrac{1}{x^2 - 1}$
26. $\dfrac{3}{x - 2} + \dfrac{1}{x + 3}$
27. $\dfrac{1}{x + y} - \dfrac{1}{x - y}$
28. $\dfrac{5}{2a + 6} + \dfrac{a}{a^2 - 9}$
29. $\dfrac{1}{x - 5} - \dfrac{1}{x + 5} + \dfrac{x + 10}{x^2 - 25}$
30. $\dfrac{6}{3x - 2} - \dfrac{8}{4x + 1}$
31. $\dfrac{7a}{3a - 4} - \dfrac{5a}{2a - 3}$
32. $\dfrac{y}{x^2 - xy} + \dfrac{1}{x}$
33. $\dfrac{1}{x + 4} + \dfrac{x}{x^2 - 16}$
34. $\dfrac{1}{x + 2} + \dfrac{2}{x - 2} + \dfrac{4}{x^2 - 4}$
35. $\dfrac{1}{a + 3} + \dfrac{a}{a^2 + 5a + 6} + \dfrac{3}{a + 4}$
36. $\dfrac{2}{x^2 - 4} + \dfrac{3}{x^2 - 3x + 2}$
37. $\dfrac{x + 1}{x - 1} - \dfrac{x - 1}{x + 1}$
38. $\dfrac{3a + 1}{3a - 1} - \dfrac{3a - 1}{3a + 1}$
39. $\dfrac{5}{x - 2} + \dfrac{3}{x^2 - 4}$
40. $\dfrac{5}{x + 1} - \dfrac{3}{x - 2}$
41. $\dfrac{3x}{x^2 - 16} - \dfrac{2}{x + 4}$
42. $\dfrac{5}{3x} - \dfrac{2}{x^2 - 5x}$

EXERCISES 2(b)

1. $10x + 15$
2. $10x - 5$
3. $3a - 3b$
4. $9ab + 9a$
5. $4xy$
6. $6mn$
7. $5a^2b - 3ab^2$
8. $8xy^2 - 2xy$
9. $x^2y + 6x^2y^2$
10. $6abc$
11. $p^2q - 5pq$
12. $6mn + 2m$
13. $5x^2 - x$
14. $6a^2 - 8a$
15. $5y^2 - 2x^2$
16. $3x^2 + 2xy$
17. $2a - 3b$
18. $2x - 4y$
19. $15n - 2m$
20. $10x + 11y$
21. $5x - 20$
22. $15a + 15b$
23. $11k + 1$
24. $2a^2 + 7a$
25. $11x^2 - 13xy$
26. $7a^2 + 2ab$
27. $a + 4b$
28. $3y - 2x$
29. $5x^2 - 5xy$
30. $9x^2 + 4x$
31. $9m^2 - 8mn$
32. $27x - 42$
33. $-x^2 - 8x - 12$
34. $3x^2 - 10x + 4$
35. $x^2 + 14x - 1$
36. $4x + 9y - 12$
37. $a^2 - 5a - 3$
38. $m^2 - 7m - 10$

EXERCISES 2(d)

1. $x^2 + 6x + 5$
2. $x^2 + 6x + 8$
3. $x^2 - 5x + 6$
4. $a^2 + a - 12$
5. $a^2 + a - 20$
6. $p^2 - 10p + 21$
7. $c^2 - c - 20$
8. $x^2 - 5x - 6$
9. $t^2 + 4t - 5$
10. $x^2 + 12x + 32$
11. $x^2 - 4x - 32$
12. $x^2 + 6x - 27$
13. $p^2 - 10p + 25$
14. $x^2 - 2x + 1$
15. $y^2 + 14y + 49$
16. $2x^2 + 13x + 15$
17. $3x^2 - 10x + 8$
18. $6m^2 + 11m - 7$
19. $12y^2 + y - 6$
20. $6x^2 - 31x + 28$
21. $35x^2 - 11x - 6$
22. $6m^2 - 41m + 44$
23. $3y^2 + 13y - 10$
24. $10z^2 - 3z - 70$
25. $6x^2 - 85x + 14$
26. $8p^2 + 2p - 3$
27. $9x^2 + 12x + 4$
28. $4p^2 - 81$
29. $6x^2 + 13x + 6$
30. $2x^2 + x - 1$
31. $16p^2 - 40p + 25$
32. $9x^2 + 24x + 16$
33. $4a^2 - 20a + 25$
34. $25y^2 - 30y + 9$
35. $16y^2 + 72y + 81$
36. $4x^2 - 12x + 9$
37. $25p^2 - 10p + 1$
38. $9p^2 + 42p + 49$
39. $4z^2 + 24z + 36$

EXERCISES 2(f)

1. $2(a + b)$
2. $5(4x - y)$
3. $a(1 + a)$
4. $2x(x - 3y)$
5. $mn(m + n)$
6. $r(r - 2s)$
7. $5a^2(a + 2b)$
8. $-5x(3 + 2x)$
9. $a(b + c + d)$
10. $p(x - y - z)$
11. $a^2b^2(5b - 18a)$
12. $3ab(a + 2ab + 3c)$
13. $a^2b(8 - 3b)$
14. $m^2n^2(9m - 5n)$
15. $p^2rq(8r + 3)$
16. $3ab(3a - 2b)$
17. $54x^2y^2(1 - xy)$
18. $4(a^2 + b^2 - c^2)$
19. $mp(1 + m - p)$
20. $5a^2b(1 - b - b^2)$

EXERCISES 2(g)

1. $(a + b)(x + 2)$
2. $(x - 4)(p - 1)$
3. $(5a - 3)(p - 6)$
4. $(c + d)(a - 3b)$
5. $(4x + 5)(x - y)$
6. $(3a - m)(2b - 3c)$
7. $(p + q - r)(a + b)$
8. $(x - y - z)(v + z)$
9. $(x^2 + 4)(2x - 1)$
10. $(a - b)(x + 2y)$
11. $(a + b)(x + y)$
12. $(a + b)(x + 4)$
13. $(x + z)(x - y)$
14. $(2x + 1)(y + z)$
15. $(a - c)(a - b)$
16. $(5y + 2x)(2 - 5y)$
17. $(a^2 + b^2)(a + 3b)$
18. $(c - 2d)(a - 2b)$
19. $(a - 3)(b + x)$
20. $(3y + 7)(x - 2)$
21. $(x - z)(x - 2y)$
22. $(a^2 - b)(a - b)$
23. $(3 + 2a)(a - b)$
24. $(2m + pn)(n + p)$
25. $(a + y)(v - 2)$
26. $(x^2 + 4)(x + 3)$
27. $(2c - d)(ax + 1)$
28. $(2x - 3)(2a + 2)$
29. $(pq + 5)(p - q)$
30. $(m^2 + n)(p + 1)$
31. $(ax + by)(x - y)$
32. $(a^2 + 1)(2a - 1)$
33. $(x - 4)(2y - z)$
34. $(x^2 + 1)(y + 1)$
35. $(a - 4)(b - 3)$
36. $(2 - y)(x - 3y)$
37. $(a^2 + b^2)(a + 3b)$
38. $(3m - 1)(m - n)$
39. $(w + y)(x - y)$
40. $2(x^2 + 1)(x - 1)$

EXERCISES 2(h)

1. $(p - q)(p + q)$
2. $(m - 1)(m + 1)$
3. $(x - 4)(x + 4)$
4. $(8 - m)(8 + m)$
5. $(3a - 5)(3a + 5)$
6. $(x - 0.6)(x + 0.6)$
7. $(ab - c)(ab + c)$
8. $(pq - r)(pq + r)$
9. $(3x - 2y)(3x + 2y)$
10. $\left(\dfrac{a}{5} - 1\right)\left(\dfrac{a}{5} + 1\right)$
11. $\left(p - \dfrac{1}{2}\right)\left(p + \dfrac{1}{2}\right)$
12. $(6c - 7d)(6c + 7d)$
13. $(x - 2)(x + 4)$
14. $(x - yz)(x + yz)$
15. $(2a - 3b)(2a + 3b)$
16. $\left(\dfrac{x}{2} - \dfrac{1}{3}\right)\left(\dfrac{x}{2} + \dfrac{1}{3}\right)$
17. $a(a + 4)$
18. $(x - y - z)(x + y + z)$
19. 9800
20. 46000
21. $ab(a - b)(a + b)$
22. $3a(2a - b)(2a + b)$
23. $3y(x - 3)(x + 3)$
24. $5x(3a - 2)(3a + 2)$
25. $6(2x - 3y)(2x + 3y)$
26. $2(2a - b)(2a + b)$
27. $(x + y - 2)(x + y + 2)$
28. $b(2a - b)$
29. $a(a - b)(a + b)$
30. $2(x - 0.2)(x + 0.2)$
31. $(x - 3)(x + 3)(x - y)$
32. $(x - 2)(x + 2)(x + 3)$
33. $(p - 4)(p + 4)(q - 1)$
34. $x(a - 1)(a + 1)$
35. $3(4a - 5b)(4a + 5b)$
36. $\left(\dfrac{x}{5} - y\right)\left(\dfrac{x}{5} + y\right)$
37. $3y^2(x - 2)(x + 2)$
38. $h(2 + h)$
39. $z(z - 1)(z + 1)$
40. $5(1 - x)(1 + x)$
41. $\left(\dfrac{a}{b} - \dfrac{b}{a}\right)\left(\dfrac{a}{b} + \dfrac{b}{a}\right)$
42. $n(m - n)(m + n)$
43. $8p$
44. $(8 - 9x)(8 + 9x)$
45. $2n^2(m - 3n)(m + 3n)$
46. $(x - 3)(x + 3)(x - 3)$
47. $2a^2(2x - 3y)(2x + 3y)$
48. $(a - b)(a + b)(a + 2)$

EXERCISES 2(j)

1. $(x + 1)(x + 3)$
2. $(x + 3)(x + 7)$
3. $(x + 3)(x + 8)$
4. $(x + 5)(x + 1)$
5. $(a + 6)(a + 1)$
6. $(a + 4)(a + 8)$
7. $(m + 5)(m + 4)$
8. $(p + 6)(p + 3)$
9. $(p + 2)(p + 9)$
10. $(p + 1)(p + 18)$
11. $(x + 4)(x + 3)$
12. $(x + 1)(x + 12)$
13. $(x + 6)(x + 2)$
14. $(x - 3)(x - 4)$
15. $(x - 12)(x - 1)$
16. $(x - 2)(x - 6)$
17. $(m - 5)(m - 4)$
18. $(m - 10)(m - 1)$
19. $(m - 20)(m - 1)$
20. $(x - 13)(x - 1)$
21. $(p + 5)(p - 3)$
22. $(p - 5)(p + 3)$
23. $(p + 15)(p - 1)$
24. $(p - 15)(p + 1)$
25. $(x - 7)(x + 5)$
26. $(x - 6)(x - 1)$
27. $(x + 9)(x + 8)$
28. $(a - 6)(a + 2)$
29. $(x - 5)(x + 2)$
30. $(a + 10)(a + 3)$
31. $(x + 12)(x - 6)$
32. $(x - 6)(x - 1)$
33. $(a + 21)(x - 2)$
34. $(x - 7)(x + 6)$
35. $(x - 21)(x + 2)$
36. $(x + 21)(x - 2)$
37. $(x - 14)(x + 3)$
38. $(x + 7)(x - 1)$
39. $(y + 11)(y - 5)$
40. $(y - 11)(y + 5)$
41. $(x + 3)(x + 11)$
42. $(x - 3)(x - 11)$

EXERCISES 2(k)

1. $(2x + 1)(x + 1)$
2. $(3x - 1)(x + 4)$
3. $(2x + 3)(x + 2)$
4. $(4a + 1)(a + 3)$
5. $(4x + 1)(x + 1)$
6. $(3a \pm 2)(a - 1)$
7. $(4x - 1)(2x - 3)$
8. $(2x + 1)(x - 5)$
9. $(13c + 6)(c - 1)$
10. $(4x + 5)(2x + 1)$
11. $(3x + 4)(2x + 3)$
12. $(3x - 1)(x - 4)$
13. $(3x - 2)(x - 5)$
14. $(3a + 7)(2a - 9)$
15. $(3x + 1)(x - 4)$
16. $(5x - 8)(2x + 1)$
17. $(2x - 1)(x + 2)$
18. $(2x - 3)(2x - 3)$
19. $(3x - 2)(3x - 2)$
20. $(x - 2)(2x - 5)$
21. $(6x - 1)(x - 14)$
22. $(5m + 9)(3m - 2)$
23. $(5a + 2)(2a - 9)$
24. $2(y - 3)(y + 1)$
25. $2(3y - 1)(2y + 3)$
26. $(3x - 2)(2x - 7)$
27. $(3x - 4)(2x - 7)$
28. $(6x - 7)(x - 2)$
29. $2(3x - 7)(x - 1)$
30. $(4x + 3)(2x - 1)$
31. $(p + 3)(6p + 7)$
32. $(5a + 2)(2a - 3)$
33. $(6y - 1)(2y + 5)$
34. $(8x - 9)(3x - 4)$
35. $(5x - 3)(3x - 2)$
36. $(3x + 1)(x - 1)$
37. $(3x + 5)(3x - 2)$
38. $(2x - 1)(x - 4)$
39. $(5p + 3)(2p + 1)$
40. $(5x + 3)(3x - 1)$
41. $(3p - 1)(p - 2)$
42. $(4x + 3)(2x - 3)$
43. $(2x + 3)^2$
44. $(3x + 5)^2$
45. $(2x - 7)^2$

EXERCISES 2(l)

1. $x(x - 3)$
2. $2a(a - 2)(a + 2)$
3. $3x(x + 3)$
4. $x(x - 8)$
5. $(x - 3)(x + 3)$
6. $(x - 9)(x + 1)$
7. $3y(x - 2y)(x + 2y)$
8. $5xy(x - 2y)(x + 2y)$
9. $(1 - b + c)(1 + b - c)$
10. $(10x - 1)(x + 1)$
11. $a(a + 2b)$
12. $6(x - 2)(x^2 + 2x + 4)$
13. $(a - 7)(a + 6)$
14. $(a - b)(m + n)$
15. $2x(x + 8)(x - 1)$
16. $3a(a + 7)(a + 1)$
17. $(x + 2y - 2)(x + 2y + 2)$
18. $(x - 5)(x + 2)$
19. $(a - 1)(a^2 + a + 1)$
20. $ab(b + c + d)$
21. $(x + y)(v - z)$
22. $x(x + 1)$
23. $(x + 4)(x - 3)$
24. $(x - 6y)(x + 6y)$
25. $4(x - 15)(x + 8)$
26. $b(x - 7y)^2$
27. $3y(2y - 1)(y + 1)$
28. $2y(3y + 1)(y + 4)$
29. $15(a - 2)(a + 2)$
30. $mn(3 - 5mn)(3 + 5mn)$
31. $5x(a - 5)(a + 5)$
32. $4xy$
33. $5t(t - 8)$
34. $(x - 2y)(x - 10y)$
35. $5(1 - 5a)(1 + 5a)$
36. $(x + y)(a + b)$
37. $(m + 6)(m - n)$
38. $(x + 3y)(x - 3y - 3z)$
39. $(x - 2)(x - 2)(x + 3)$
40. $(x - l)(mx - y)$
41. $(1 - x)(3 + x)$
42. $2x(3x + 4)(x - 7)$
43. $(x + a)(x - 2)$
44. $(x - 18)(x + 8)$
45. $(ax + 1)(2c - d)$
46. $(p + 5)(p^2 - 5p + 25)$
47. $\left(\dfrac{a}{2} - 1\right)\left(a^2 + \dfrac{a}{2} + 1\right)$
48. $(x + h + 1)(x^2 + 2xh + h^2 - x - h + 1)$
49. $(4 - \pi)r^2$
50. $(\pi - 2)r^2$
51. $\pi(R - r)(R + r)$
52. $(8 - \pi)r^2$
53. $\pi a(a - b)$
54. $\pi(R - 2r)(R + 2r)$
55. $4(4 - \pi)r^2$
56. $2(6 - \pi)r^2$
57. $a(a + b + c)$

EXERCISES 2(m)

1. $2a - b$
2. $\dfrac{3x + 2y}{3}$
3. 7
4. $\dfrac{2x - y}{2y}$
5. $\dfrac{2(2a - b)}{3a}$
6. 2
7. $\dfrac{1}{a}$
8. $1 + m$
9. $m - n$
10. $p - q$
11. $\dfrac{x + y}{2}$
12. $\dfrac{2(s - 6)}{r + s}$
13. $\dfrac{x - y}{x + y}$
14. k
15. $\dfrac{x - 3}{x}$
16. $\dfrac{5a}{b}$
17. $\dfrac{4x}{x + y}$
18. $\dfrac{x - 1}{x + 6}$
19. $\dfrac{a}{b}$
20. $\dfrac{a - b}{a}$
21. $\dfrac{x + 1}{x - 4}$
22. $\dfrac{x - 4}{x + 1}$
23. $\dfrac{x + 1}{x - 2}$
24. $\dfrac{x - 2}{x + 4}$
25. $\dfrac{x + 2}{x - 5}$
26. $\dfrac{4xy(x + 2)}{x + 4}$
27. $\dfrac{m + 2}{m}$
28. $\dfrac{x^2}{y}$
29. 1
30. $\dfrac{a^2}{b}$
31. 1
32. $2y$
33. 1
34. $\dfrac{a - b}{b}$
35. $\dfrac{m - 5}{m}$
36. $\dfrac{x^2 - xy + y^2}{x - y}$
37. $\dfrac{2}{2x - 1}$
38. $\dfrac{2}{x^2 + xy + y^2}$
39. $3x^2 + 3xh + h^2$
40. $\dfrac{3x^2 - 3xy + y^2}{2x - y}$

1. $\dfrac{x}{30}$
2. $\dfrac{7x}{8}$
3. $\dfrac{29a}{30}$
4. $\dfrac{11y}{12}$

5. $\dfrac{-2a+11}{15}$
6. $\dfrac{3x+y}{6}$
7. $\dfrac{3x+1}{12}$
8. $\dfrac{7m-3n}{10}$

9. $\dfrac{2x-y}{12}$
10. $\dfrac{-a-8b}{18}$
11. $\dfrac{7a+11b}{12}$
12. $\dfrac{1}{3x}$

13. $\dfrac{3a+1}{a^2}$
14. $\dfrac{1-2a}{ab}$
15. $\dfrac{m^2-n^2}{mn}$
16. $\dfrac{4z+3x}{xyz}$

17. $\dfrac{5b-2a}{a^2b^2}$
18. $\dfrac{c+a^2}{abc}$
19. $\dfrac{4a-11}{6a}$
20. $\dfrac{2x+5}{3(x+1)}$

21. $\dfrac{3x-1}{x^2}$

EXERCISES 2(o)

1. $(x-3)(x+3)$
2. x^2-25
3. $x(x-2)$

4. $6(x-2)$
5. x^2-4x
6. $x(x-4)(x+4)$

7. x^2-1
8. $2(x-3)(x+3)$
9. x^2+4x+4

10. x^2-y^2
11. $(x-2)(x+2)(x+1)$
12. $xy(x^2-y^2)$

13. $x(x-2)^2$
14. $x(x-3)(x+3)$
15. x^2-25

16. $xy(x^2-y^2)$
17. $\dfrac{(a-b)(a+b)}{2a}$
18. $\dfrac{x+5y}{(x-y)(x+y)}$

19. $\dfrac{x+y}{x-y}$
20. $\dfrac{x^2+2xy-y^2}{(x-y)(x+y)}$
21. $\dfrac{4a}{a^2-b^2}$

22. $\dfrac{3-x}{x^2-4}$
23. $\dfrac{1}{x+y}$
24. $\dfrac{2x-1}{(x-2)^2}$

25. $\dfrac{4}{(x-1)(x-3)(x+1)}$
26. $\dfrac{4x+7}{(x-2)(x+3)}$
27. $\dfrac{-2y}{(x+y)(x-y)}$

28. $\dfrac{7a-15}{2(a^2-9)}$
29. $\dfrac{x+20}{(x-5)(x+5)}$
30. $\dfrac{22}{(3x-2)(4x+1)}$

31. $\dfrac{-a^2-a}{(3a-4)(2a-3)}$
32. $\dfrac{1}{x-y}$
33. $\dfrac{2x-4}{x^2-16}$

34. $\dfrac{2}{x-2}$
35. $\dfrac{2}{a+2}$
36. $\dfrac{x-7}{(x-2)(x+2)(x-1)}$

37. $\dfrac{4x}{(x-1)(x+1)}$
38. $\dfrac{12a}{(3a-1)(3a+1)}$
39. $\dfrac{5x+13}{(x-2)(x+2)}$

40. $\dfrac{2x-13}{(x+1)(x-2)}$
41. $\dfrac{x+8}{(x-4)(x+4)}$
42. $\dfrac{5x-31}{3x(x-5)}$