Algebra practice

Skill 2.1 Adding and subtracting like terms

1. $3ab + 2ba + 5a + 6a$
2. $6ab + 2a - 4a - 6ba$
3. $19a^2b + 5b + 3b - 14ba$
4. $6ab^2 + 11ba - 14b^2a + 12ab$
5. $6a^2b + 7ab^2 + 6a^2 + 4a^2b$
6. $-4a^2 + 5b^2a - 4b^2a + 6a^2$
7. $9ab + 12ba^2 + 3ab - 12ba$
8. $7a^2b + 2 + 14b + 12ab^2 - 11ba^2$
9. $12a^2b - 12b - 18b^2a - 12a^2b$
10. $15ac + 12c - 14c^2a + 5ca - 2ac^2$

Skill 2.2 Multiplying algebraic expressions

1. $4a \times 3c$
2. $5c \times 2a$
3. $6a \times 4de$
4. $10a \times 3b$
5. $9a \times 2b$
6. $10ab \times 2c$
7. $-2a \times 3d \times e$
8. $11a \times 4b \times 2c$
9. $12a \times 4b \times 2$
10. $5c \times 2a \times 3b$

Skill 2.3 Dividing algebraic expressions

1. $5a \div 10a$
2. $12ab \div 6b$
3. $121ab \div 11b$
4. $25ab \div 5bc$
5. $26ab \div 2c$
6. $36ac \div 24cd$
7. $18ac \div cd$
8. $abd \div 3de$
9. $14acd \div 7ac$
10. $15ace \div 20e$

Skill 2.4 Expansion of brackets

Simplify the following:

1. $2(a - 2b)$
2. $b(a - 4c)$
3. $ac(b - 4)$
4. $\frac{a}{3}(9 + 2c)$
5. $-2c(d - 2e + 5a)$
6. $(a + 1)(a + 2)$
7. $(b - 2)(b + 2)$
8. $(a - 4)(a + 3)$
9. $(2a + 3)(a - 1)$
10. $(3a + 5)(2a - 1)$

Skill 2.5 Factorising algebraic expressions

Factorise the following:

Common factor

1. $ab + 2a$
2. $5c + 15$
3. $21ac + 7c$
4. $12ac + 4a$
5. $3ac - 2c$

Difference of perfect squares

6. $b^2 - c^2$
7. $9a^2 - 1$
8. $49a^2b^2 - 25$
9. $16a^2 - 9b^4$
10. $25 - 9a^4b^2$
11. $a^2b^2 - c^2$
12. $9a^2 - 16b^2$
13. $100a^2 - 9b^2$
14. $16a^2b^4 - 9c^2$
15. $81a^2b^6 - 1$

Quadratic trinominals

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

Grouping

26. $ab - 3b + 2a - 6$
27. $ab - 2a + 3b - 6$
28. $ac + bc + 4a + 4b$
29. $2b - 2c - ab + ac$
30. $3a + ad - 3b - bd$
31. $2b - bc + 2a - ac$
32. $3b + 3d + ab + ad$

Skill 2.6 Solving equations by removing one number

Solve these equations:

1. $a - 3 = 4$
2. $a - 9 = 2$
3. $a - 1.4 = 6$
4. $a - 3 = 2.1$
5. $a + 3.8 = 17$
6. $a + 5.8 = -2$
7. $3a = 4$
8. $4a = -2$
9. $5a = -3$
10. $\frac{a}{4} = -3$
11. $\frac{a}{11} = -6$
12. $\frac{a}{2} = 5$

Skill 2.7 Solving equations by removing two numbers

Solve these equations:

1. $2a + 5 = 9$
2. $3a - 4 = 8$
3. $7a - 1 = 48$
4. $6a + 4 = -26$
5. $\frac{3a}{4} = 20$
6. $\frac{2a}{5} = 12$
7. $\frac{6a}{7} = -12$
8. $\frac{a + 4}{3} = 5$
9. $\frac{a - 4}{3} = 5$
10. $\frac{a - 6}{3} = -2$

Skill 2.8 Solving equations with brackets

Solve these equations:

1. $3(a + 4) = 12$
2. $5(a - 4) = -20$
3. $2(a - 4) = -20$
4. $6(a + 4) = 30$
5. $\frac{3(a + 1)}{2} = 6$
6. $\frac{2(a - 2)}{3} = 8$
7. $\frac{5(a - 2)}{4} = -20$
8. $\frac{8(a + 1)}{7} = 16$
9. $\frac{12(a - 4)}{7} = -36$
10. $\frac{3(a + 8)}{5} = -12$

Skill 2.9 Solving e̶̶̶̶̶s with pronumerals on bo̶̶̶̶s

Solve these equations:

1. $2a + 6 = a - 4$
2. $5a + 2 = 3a + 8$
3. $11a - 4 = 6a + 1$
4. $a + 6 = 4a + 3$
5. $2a + 1 = 5a - 8$
6. $2(a + 1) = a - 11$
7. $3(a + 4) = a + 8$
8. $3(2a + 1) = 5a + 12$
9. $2(a + 5) = 3a - 6$
10. $a + 1 = 3(a - 5)$

Skill 2.10 Solving equations by removing more than two numbers

Solve:

1. $\dfrac{3x+1}{2} + 6 = 14$
2. $\dfrac{3x-5}{2} - 2 = 0$
3. $\dfrac{x-4}{3} - 3 = 4$
4. $\dfrac{x+4}{5} + 6 = -11$
5. $\dfrac{3(x+1)}{4} - 6 = -3$
6. $\dfrac{2(x+4)}{3} + 6 = 12$
7. $\dfrac{5(x-3)}{4} + 8 = 28$
8. $\dfrac{4(2x+7)}{5} - 4 = 8$

Skill 2.11 Simultaneous equations

(a) Solve these simultaneous equations using the substitution method:

1. $y = 2x$, $\quad x + y = 21$
2. $y = 3x$, $\quad x + y = 20$
3. $y = 3x$, $\quad x + y = -20$
4. $y = x + 1$, $\quad 2x + y = 10$
5. $y = x - 1$, $\quad 3x + y = 23$

(b) Solve these simultaneous equations using the elimination method:

6. $x + y = 4$, $\quad x - y = 10$
7. $2x + y = 5$, $\quad -2x + y = 7$
8. $x + 2y = 11$, $x - 2y = -3$
9. $x + 2y = 3$, $\quad 2x - y = 1$
10. $x + 3y = 5$, $\quad 2x - y = 3$

Skill 2.12 Solving quadratic equations

(a) Solve these equations:

1. $b^2 = 25$
2. $2c^2 = 50$
3. $\dfrac{b^2}{2} = 32$
4. $(a - 2)(a + 3) = 0$
5. $(a + 4)\left(\dfrac{a}{2} + 1\right) = 0$
6. $\left(\dfrac{a}{4} + 1\right)(a - 2) = 0$
7. $2(a + 1)(a - 4) = 0$

(b) Factorise first and then solve the equations:

8. $x^2 + 11x + 18 = 0$
9. $x^2 + 5x + 6 = 0$
10. $a^2 - 2x - 15 = 0$
11. $a^2 + 2x - 15 = 0$
12. $a^2 + a - 56 = 0$
13. $a^2 - a - 30 = 0$
14. $a^2 - 4a + 4 = 0$
15. $a^2 + 12a + 20 = 0$

Skill 2.13 Evaluating formulas

The bank interest (I) paid on a principle investment (P) for a rate (R) over a period of time (T) is given by the formula: $I = \dfrac{PRT}{100}$

Find the interest paid in these situations:

(a) $P = \$20\,000$, $R = 12\%$, $T = 2$ years
(b) $P = \$100\,000$, $R = 8.3\%$, $T = 3$ years
(c) $P = \$15\,000$, $R = 5\%$, $T = 5$ years
(d) $P = \$30\,000$, $R = 10\%$, $T = 4$ years

Skill 2.14 Transposing equations

Transpose these equations to make a the subject:

1. $\dfrac{2a}{b} = c$
2. $a + b = 3c$
3. $5a + 2 = c$
4. $6a + 2b = 3$
5. $\dfrac{a+1}{2} = 5b$
6. $a(b + 1) = c$
7. $\dfrac{a}{2} + 3 = b$
8. $9a - 3 = b + c$
9. $3(a + 2) = b$
10. $2(a - 4) = b$

11. For the equation $F = ma$

(a) make m the subject
(b) find the value of m when:
   (i) $F = 100$, $a = 20$
   (ii) $F = 20$, $a = 2$
   (iii) $F = 15$, $a = 3$

2 Algebra

Skill 2.1

1. $5ab + 11a$
2. $-2a$
3. $19a^2b + 8b - 14ab$
4. $-8ab^2 + 23ab$
5. $6a^2 + 10a^2b + 7ab^2$
6. $ab^2 + 2a^2$
7. $12a^2b$
8. $2 + 14b - 4a^2b + 12ab^2$
9. $-12b - 18ab^2$
10. $12c + 20ac - 16ac^2$

Skill 2.2

1. $12ac$
2. $10ac$
3. $24ade$
4. $30ab$
5. $18ab$
6. $20abc$
7. $-6ade$
8. $88abc$
9. $96ab$
10. $30abc$

Skill 2.3

1. $\dfrac{1}{2}$
2. $2a$
3. $11a$
4. $\dfrac{5a}{c}$
5. $\dfrac{13ab}{c}$
6. $\dfrac{3a}{2d}$
7. $\dfrac{18a}{d}$
8. $\dfrac{ab}{3e}$
9. $2d$
10. $\dfrac{3ac}{4}$

Skill 2.4

1. $2a - 4b$
2. $ab - 4bc$
3. $abc - 4ac$
4. $3a + \dfrac{2ac}{3}$
5. $-2cd + 4ce - 10ac$
6. $a^2 + 3a + 2$
7. $b^2 - 4$
8. $a^2 - a - 12$
9. $2a^2 + a - 3$
10. $6a^2 + 7a - 5$

Skill 2.5

1. $a(b + 2)$
2. $5(c + 3)$
3. $7c(3a + 1)$
4. $4a(3c + 1)$
5. $c(3a - 2)$
6. $(b - c)(b + c)$
7. $(3a - 1)(3a + 1)$
8. $(7ab - 5)(7ab + 5)$
9. $(4a - 3b^2)(4a + 3b^2)$
10. $(5 - 3a^2b)(5 + 3a^2b)$
11. $(ab - c)(ab + c)$
12. $(3a - 4b)(3a + 4b)$
13. $(10a - 3b)(10a + 3b)$
14. $(4ab^2 - 3c)(4ab^2 + 3c)$
15. $(9ab^3 - 1)(9ab^3 + 1)$
16. $(a + 4)(a + 1)$
17. $(a + 7)(a + 2)$
18. $(a - 5)(a + 3)$
19. $(a - 4)(a + 3)$
20. $(a + 5)(a - 1)$
21. $(a + 8)(a - 2)$
22. $(a - 4)(a + 2)$
23. $(a + 1)(a + 1)$
24. $(a + 2)(a + 5)$
25. $(a - 5)(a + 2)$
26. $(b + 2)(a - 3)$
27. $(a + 3)(b - 2)$
28. $(c + 4)(a + b)$
29. $(2 - a)(b - c)$
30. $(a - b)(3 + d)$
31. $(b + a)(2 - c)$
32. $(3 + a)(b + d)$

Skill 2.6

1. $a = 7$
2. $a = 11$
3. $a = 7.4$
4. $a = 5.1$
5. $a = 13.2$
6. $a = -7.8$
7. $a = 1\frac{1}{3}$
8. $a = -\frac{1}{2}$
9. $a = -\frac{3}{5}$
10. $a = -12$
11. $a = -66$
12. $a = 10$

Skill 2.7

1. $a = 2$
2. $a = 4$
3. $a = 7$
4. $a = -5$
5. $a = 26\frac{2}{3}$
6. $a = 30$
7. $a = -14$
8. $a = 11$
9. $a = 19$
10. $a = 0$

Skill 2.8

1. $a = 0$
2. $a = 0$
3. $a = -6$
4. $a = 1$
5. $a = 3$
6. $a = 14$
7. $a = -14$
8. $a = 13$
9. $a = -17$
10. $a = -28$

Skill 2.9

1. $a = -10$
2. $a = 3$
3. $a = 1$
4. $a = 1$
5. $a = 3$
6. $a = -13$
7. $a = -2$
8. $a = 9$
9. $a = 16$

Skill 2.10

1. $x = 5$
2. $x = 3$
3. $x = 25$
4. $x = -89$
5. $x = 3$
6. $x = 5$
7. $x = 19$
8. $x = 4$

Skill 2.11

1. $x = 7, y = 14$
2. $x = 5, y = 15$
3. $x = -5, y = -15$
4. $x = 3, y = 4$
5. $x = 6, y = 5$
6. $x = 7, y = -3$
7. $x = -\frac{1}{2}, y = 6$
8. $x = 4, y = 3\frac{1}{2}$
9. $x = 1, y = 1$
10. $x = 2, y = 1$

Skill 2.12

1. $b = \pm 5$
2. $c = \pm 5$
3. $b = \pm 8$
4. $a = 2, a = -3$
5. $a = -4, a = -2$
6. $a = -4, a = 2$
7. $a = -1, a = 4$
8. $x = -2, x = -9$
9. $x = -2, x = -3$
10. $a = 5, a = -3$
11. $a = -5, a = 3$
12. $a = -8, a = 7$
13. $a = 6, a = -5$
14. $a = 2$
15. $a = -2, a = -10$

Skill 2.13

(a) $4800 (b) $24 900 (c) $3750 (d) $12 000

Skill 2.14

1. $a = \dfrac{bc}{2}$
2. $a = 3c - b$
3. $a = \dfrac{c - 2}{5}$
4. $a = \dfrac{3 - 2b}{6}$
5. $a = 10b - 1$
6. $a = \dfrac{c}{(b + 1)}$
7. $a = 2(b - 3)$
8. $a = \dfrac{b + c + 3}{9}$
9. $a = \dfrac{b}{3} - 2$ or $a = \dfrac{b - 6}{3}$
10. $a = \dfrac{b}{2} + 4$ or $a = \dfrac{b + 8}{2}$
11. (a) $m = \dfrac{F}{a}$

(b) (i) $m = 5$ (ii) $m = 10$ (iii) $m = 5$