

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 $a^2b^2 - c^2$

$$12 \quad 9a^2 - 16b^2 \qquad 13 \quad 100a^2 - 9b^2$$

$$14 \quad 16a^2b^4 - 9c^2 \qquad 15 \quad 81a^2b^6 - 1$$

Quadratic trinomials

$$16 \quad a^2 + 5a + 4 \qquad 17 \quad a^2 + 9a + 14$$

$$18 \quad a^2 - 2a - 15 \qquad 19 \quad a^2 - a - 12$$

$$20 \quad a^2 + 4a - 5 \qquad 21 \quad a^2 + 6a - 16$$

$$22 \quad a^2 - 2a - 8 \qquad 23 \quad a^2 + 2a + 1$$

$$24 \quad a^2 + 7a + 10 \qquad 25 \quad a^2 - 3a - 10$$

Grouping

$$26 \quad ab - 3b + 2a - 6 \qquad 27 \quad ab - 2a + 3b - 6$$

$$28 \quad ac + bc + 4a + 4b \qquad 29 \quad 2b - 2c - ab + ac$$

$$30 \quad 3a + ad - 3b - bd \qquad 31 \quad 2b - bc + 2a - ac$$

$$32 \quad 3b + 3d + ab + ad$$

Skill 2.6 Solving equations by removing one number

Solve these equations:

$$1 \quad a - 3 = 4$$

$$2 \quad a - 9 = 2$$

$$3 \quad a - 1.4 = 6$$

$$4 \quad a - 3 = 2.1$$

$$5 \quad a + 3.8 = 17$$

$$6 \quad a + 5.8 = -2$$

$$7 \quad 3a = 4$$

$$8 \quad 4a = -2$$

$$9 \quad 5a = -3$$

$$10 \quad \frac{a}{4} = -3$$

$$11 \quad \frac{a}{11} = -6$$

$$12 \quad \frac{a}{2} = 5$$

Skill 2.7 Solving equations by removing two numbers

Solve these equations:

$$1 \quad 2a + 5 = 9$$

$$2 \quad 3a - 4 = 8$$

$$3 \quad 7a - 1 = 48$$

$$4 \quad 6a + 4 = -26$$

$$5 \quad \frac{3a}{4} = 20$$

$$6 \quad \frac{2a}{5} = 12$$

$$7 \quad \frac{6a}{7} = -12$$

$$8 \quad \frac{a + 4}{3} = 5$$

$$9 \quad \frac{a - 4}{3} = 5$$

$$10 \quad \frac{a - 6}{3} = -2$$

Skill 2.8 Solving equations with brackets

Solve these equations:

$$1 \quad 3(a + 4) = 12$$

$$2 \quad 5(a - 4) = -20$$

$$3 \quad 2(a - 4) = -20$$

$$4 \quad 6(a + 4) = 30$$

$$5 \quad \frac{3(a + 1)}{2} = 6$$

$$6 \quad \frac{2(a - 2)}{3} = 8$$

$$7 \quad \frac{5(a - 2)}{4} = -20$$

$$8 \quad \frac{8(a + 1)}{7} = 16$$

$$9 \quad \frac{12(a - 4)}{7} = -36$$

$$10 \quad \frac{3(a + 8)}{5} = -12$$

Skill 2.9 Solving equations with pronumerals on both sides

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

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 $x + 2y = 11, \quad x - 2y = -3$
- 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 $\frac{b^2}{2} = 32$
- 4 $(a - 2)(a + 3) = 0$
- 5 $(a + 4)\left(\frac{a}{2} + 1\right) = 0$
- 6 $\left(\frac{a}{4} + 1\right)(a - 2) = 0$
- 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: $I = \frac{PRT}{100}$

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 $\frac{2a}{b} = c$
- 2 $a + b = 3c$
- 3 $5a + 2 = c$
- 4 $6a + 2b = 3$
- 5 $\frac{a+1}{2} = 5b$
- 6 $a(b+1) = c$
- 7 $\frac{a}{2} + 3 = b$
- 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

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|---------------------------|------------------------------|
| 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

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

Skill 2.3

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

Skill 2.4

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

Skill 2.5

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|-----------------------------|-------------------------------|
| 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

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|----------------------|----------------------|----------------------|
| 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

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|-----------------------|------------|-------------|------------|
| 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

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|-------------|--------------|-------------|------------|
| 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

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|-------------|-----------|-------------|
| 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 $a = 16$ |

Answers

Skill 2.10

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|-------------|-----------|------------|
| 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

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|-----------------------------|-----------------------------|
| 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

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|----------------------|--------------------|
| 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

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|---|-------------------------|
| 1 $a = \frac{bc}{2}$ | 2 $a = 3c - b$ |
| 3 $a = \frac{c-2}{5}$ | 4 $a = \frac{3-2b}{6}$ |
| 5 $a = 10b - 1$ | 6 $a = \frac{c}{(b+1)}$ |
| 7 $a = 2(b-3)$ | 8 $a = \frac{b+c+3}{9}$ |
| 9 $a = \frac{b}{3} - 2$ or $a = \frac{b-6}{3}$ | |
| 10 $a = \frac{b}{2} + 4$ or $a = \frac{b+8}{2}$ | |
| 11 (a) $m = \frac{F}{a}$ | |
| (b) (i) $m = 5$ (ii) $m = 10$ (iii) $m = 5$ | |