

# secondary 2 mathematics@2024-12-01

## with solutions

### exponents

1. Simplify  $a \times a^2$ .
2. Simplify  $a^3 \times a^4$ .
3. Simplify  $a^a \times a^b$ .
4. Simplify  $a^5 \div a^2$ .
5. Simplify  $a^2 \div a^5$ .
6. Simplify  $(a^3)^9$ .
7. Simplify  $(a^9)^x$ .
8. Simplify  $(x^y)^x$ .
9. Simplify  $\left(\frac{c}{d}\right)^4$ .
10. Simplify  $\left(\frac{c^2}{d}\right)^4$ .
11. Simplify  $(xy)^a$ .
12. Simplify  $xy^a$ .
13. Simplify  $((xy)^a)^b$ .
14. Simplify  $\left(\frac{ac}{bd}\right)^e$ .
15. Simplify  $\left(cd^2\left(\frac{a^2}{b^3}\right)^e\right)^f$ .

### expand

1. Expand  $(7 - 3y)(y - 3)$ .
2. Expand  $(-7w - 4)(2w - 5)$ .
3. Expand  $(3v + 7)(6v - 4)$ .
4. Expand  $(4 - 2m)(m + 6)$ .
5. Expand  $(1 - 3x)(3x + 3)$ .
6. Expand  $4y(7y + 5)(7y + 7)$ .
7. Expand  $2(-7n - 6)(-n - 5)n$ .
8. Expand  $21s^2(3s + 7)$ .
9. Expand  $-6v(35v^2 - 39v - 14)$ .
10. Expand  $7w(3w + 2)(4w + 5)(7w + 6)$ .

### factor

1. Factor  $a^2 - b^2$ .
2. Factor  $a^2 - 2a - 15$ .

3. Factor  $a^2 + a - 20$ .
  4. Factor  $n^2 - 10n + 21$ .
  5. Factor  $2y^2 + 16y + 14$ .
  6. Factor  $n^2 + 6n + 5$ .
  7. Factor  $x^2 - 5xz - 6z^2$ .
  8. Factor  $3m^2 + 12mn - 36n^2$ .
  9. Factor  $u^4 + 8u^2 + 15$ .
  10. Factor  $m^4 + 2m^2n^2 + n^4$ .
  11. Factor  $(3x)^3 - (4y)^3$ .
  12. Factor  $(3z)^3 + (4w)^3$ .
  13. Factor  $27a^3 - 64b^3$ .
  14. Factor  $27c^3 + 64d^3$ .
  15. Factor  $a^2 + 2ab + b^2$ .
  16. Factor  $4c^2 + 4cd + d^2$ .
  17. Factor  $8e^2 + 8ef + 2f^2$ .
  18. Factor  $v^3 - v^2 - 6v$ .
  19. Factor  $2a^4 + 12a^3 + 16a^2$ .
  20. Factor  $2n^4m - 22n^2m^2 + 56m^3$ .
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## exponents (solutions)

1.  $a \times a^2 = a^{1+2} = a^3$
2.  $a^3 \times a^4 = a^{3+4} = a^7$
3.  $a^a \times a^b = a^{a+b}$
4.  $a^5 \div a^2 = a^{5-2} = a^3$
5.  $a^2 \div a^5 = \frac{1}{a^{5-2}} = \frac{1}{a^3}$
6.  $(a^3)^9 = a^{3 \times 9} = a^{27}$
7.  $(a^9)^x = a^{9 \times x} = a^{9x}$
8.  $(x^y)^x = x^{y \times x} = x^{yx}$
9.  $\left(\frac{c}{d}\right)^4 = \frac{c^4}{d^4}$
10.  $\left(\frac{c^2}{d}\right)^4 = \frac{(c^2)^4}{d^4} = \frac{c^{2 \times 4}}{d^4} = \frac{c^8}{d^4}$
11.  $(xy)^a = x^a y^a$
12.  $xy^a$  is already simplified.
13.  $((xy)^a)^b = (xy)^{a \times b} = (xy)^{ab} = x^{ab} y^{ab}$
14.  $\left(\frac{ac}{bd}\right)^e = \frac{(ac)^e}{(bd)^e} = \frac{a^e c^e}{b^e d^e}$

15.

$$\begin{aligned}
 & \left( cd^2 \left( \frac{a^2}{b^3} \right)^e \right)^f \\
 &= \left( cd^2 \left( \frac{(a^2)^e}{(b^3)^e} \right) \right)^f \\
 &= \left( cd^2 \left( \frac{a^{2e}}{b^{3e}} \right) \right)^f \\
 &= \left( \frac{cd^2 a^{2e}}{b^{3e}} \right)^f \\
 &= \frac{(cd^2 a^{2e})^f}{(b^{3e})^f} \\
 &= \frac{c^f d^{2f} e^{2ef}}{b^{3ef}}
 \end{aligned}$$

## expand (solutions)

1.  $(7 - 3y)(y - 3) = 7y - 21 - 3y^2 + 9y = -3y^2 + 16y - 21$
2.  $(-7w - 4)(2w - 5) = -14w^2 + 35w - 8w + 20 = -14w^2 + 27w + 20$
3.  $(3v + 7)(6v - 4) = 18v^2 - 12v + 42v - 28 = 18v^2 + 30v - 28$
4.  $(4 - 2m)(m + 6) = 4m + 24 - 2m^2 - 12m = -2m^2 - 8m + 24$
5.  $(1 - 3x)(3x + 3) = 3x + 3 - 9x^2 - 9x = -9x^2 - 6x + 3$

6.

$$\begin{aligned}
 & 4y(7y + 5)(7y + 7) \\
 &= 4y(49y^2 + 49y + 35y + 35) \\
 &= 4y(49y^2 + 84y + 35) \\
 &= 196y^3 + 336y^2 + 140y
 \end{aligned}$$

7.

$$\begin{aligned}
 & 2(-7n - 6)(-n - 5)n \\
 &= 2n(-7n - 6)(-n - 5) \\
 &= 2n(7n^2 + 35n + 6n + 30) \\
 &= 2n(7n^2 + 41n + 30) \\
 &= 14n^3 + 82n^2 + 60n
 \end{aligned}$$

$$8. \quad 21s^2(3s + 7) = 63s^3 + 147s^2$$

$$9. \quad -6v(35v^2 - 39v - 14) = -210v^3 + 234v^2 + 84v$$

10.

$$\begin{aligned}
 & 7w(3w + 2)(4w + 5)(7w + 6) \\
 &= 7w(3w + 2)(28w^2 + 24w + 35w + 30) \\
 &= 7w(3w + 2)(28w^2 + 59w + 30) \\
 &= 7w(84w^3 + 177w^2 + 90w + 56w^2 + 118w + 60) \\
 &= 7w(84w^3 + 233w^2 + 208w + 60) \\
 &= 588w^4 + 1631w^3 + 1456w^2 + 420w
 \end{aligned}$$

## factor (solutions)

1.  $a^2 - b^2 = (a + b)(a - b)$
2.  $a^2 - 2a - 15 = (a + 3)(a - 5)$
3.  $a^2 + a - 20 = (a + 5)(a - 4)$
4.  $n^2 - 10n + 21 = (n - 3)(n - 7)$
5.  $2y^2 + 16y + 14 = 2(y^2 + 8y + 7) = 2(y + 7)(y + 1)$
6.  $n^2 + 6n + 5 = (n + 5)(n + 1)$
7.  $x^2 - 5xz - 6z^2 = (x + z)(x - 6z)$
8.  $3m^2 + 12mn - 36n^2 = 3(m^2 + 4mn - 12n^2) = 3(m + 6n)(m - 2n)$
9.  $u^4 + 8u^2 + 15 = (u^2)^2 + 8(u^2) + 15 = (u^2 + 5)(u^2 + 3)$
10.  $m^4 + 2m^2n^2 + n^4 = (m^2)^2 + 2(m^2)(n^2) + (n^2)^2 = (m^2 + n^2)^2$
11. 
$$\begin{aligned} & (3x)^3 - (4y)^3 \\ &= (3x - 4y)((3x)^2 + (3x)(4y) + (4y)^2) \\ &= (3x - 4y)(9x^2 + 12xy + 16y^2) \end{aligned}$$
12. 
$$\begin{aligned} & (3z)^3 + (4w)^3 \\ &= (3z + 4w)((3z)^2 - (3z)(4w) + (4w)^2) \\ &= (3z + 4w)(9z^2 - 12zw + 16w^2) \end{aligned}$$
13. 
$$\begin{aligned} & 27a^3 - 64b^3 \\ &= 3^3a^3 - 4^3b^3 \\ &= (3a)^3 - (4b)^3 \\ &= (3a - 4b)((3a)^2 + (3a)(4b) + (4b)^2) \\ &= (3a - 4b)(9a^2 + 12ab + 16b^2) \end{aligned}$$
14. 
$$\begin{aligned} & 27c^3 + 64d^3 \\ &= 3^3c^3 + 4^3d^3 \\ &= (3c)^3 + (4d)^3 \\ &= (3c + 4d)((3c)^2 - (3c)(4d) + (4d)^2) \\ &= (3c + 4d)(9c^2 - 12cd + 16d^2) \end{aligned}$$
15.  $a^2 + 2ab + b^2 = (a + b)^2$
16.  $4c^2 + 4cd + d^2 = (2c)^2 + 2(2c)d + d^2 = (2c + d)^2$
17.  $8e^2 + 8ef + 2f^2 = 2(4e^2 + 4ef + f^2) = 2((2e)^2 + 2(2e)f + f^2) = 2(2e + f)^2$
18.  $v^3 - v^2 - 6v = v(v^2 - v - 6) = v(v + 2)(v - 3)$
19.  $2a^4 + 12a^3 + 16a^2 = 2a^2(a^2 + 6a + 8) = 2a^2(a + 4)(a + 2)$

20.

$$\begin{aligned} & 2n^4m - 22n^2m^2 + 56m^3 \\ &= 2m (n^4 - 11n^2m + 28m) \\ &= 2m \left( (n^2)^2 - 11(n^2)m + 28m^2 \right) \\ &= 2m (n^2 - 4m) (n^2 - 7m^2) \end{aligned}$$