

1.

$$3^4 \cdot 3^5 \cdot 3^2 = 3^{4+5+2} = 3^{11}$$

$$12^3 \cdot 12^5 \cdot 12^2 = 12^{3+5+2} = 12^{10}$$

$$x^3 \cdot x^2 \cdot x = x^{3+2+1} = x^6$$

$$d^3 \cdot d^5 \cdot d^4 = d^{3+5+4} = d^{12}$$

$$k^3 \cdot k^5 \cdot m^2 \cdot m^2 = k^{3+5} \cdot m^{2+2} = k^8 \cdot m^4$$

$$x^5 \cdot y^3 \cdot x^2 \cdot y = x^{5+2} \cdot y^{3+1} = x^7 \cdot y^4$$

$$a^2 \cdot b \cdot b^3 \cdot a = a^{2+1} \cdot b^{1+3} = a^3 \cdot b^4$$

$$p^4 \cdot q^6 \cdot p \cdot q^5 = p^{4+1} \cdot q^{6+5} = p^5 \cdot q^{11}$$

2.

$$x^2 \cdot x^n = x^{2+n}$$

$$b^m \cdot b^3 = b^{3+m}$$

$$y^a \cdot y = y^{a+1}$$

$$x^m \cdot x^m = x^{m+m} = x^{2m}$$

$$a^5 \cdot a^{2x} = a^{5+2x}$$

$$z^{2m} \cdot z^m = z^{2m+m} = z^{3m}$$

$$a^{3m} \cdot a^{2m} \cdot a^m = a^{3m+2m+m} = a^{6m}$$

$$m^{3x} \cdot m^{4x} \cdot m^{2x} = m^{3x+4x+2x} = m^{9x}$$

3.

$$x^3 \cdot x^{m-2} = x^{3+m-2} = x^{m+1}$$

$$a^5 \cdot a^{x-7} = a^{5+x-7} = a^{x-2}$$

$$y^{2m} \cdot y^{m-1} = y^{2m+m-1} = y^{3m-1}$$

$$x^{p-4} \cdot x^{p+2} = x^{p-4+p+2} = x^{2p-2}$$

$$a^{2x} \cdot a^{x+7} \cdot a^{3x-4} = a^{2x+x+7+3x-4} = a^{6x+3}$$

$$x^{m+2} \cdot x^{2m-4} \cdot x^{2m+3} = x^{m+2+2m-4+2m+3} = x^{5m+1}$$

$$z^{p-1} \cdot z^{3p+4} \cdot z^{5p-8} = z^{p-1+3p+4+5p-8} = z^{9p-5}$$

$$y^{m-2} \cdot y^{2m-5} \cdot y^{m+8} = y^{m-2+2m-5+m+8} = y^{4m+1}$$

4.

$$x^2 \cdot (x^3 + x^4) = x^2 \cdot x^3 + x^2 \cdot x^4 = x^{2+3} + x^{2+4} = x^5 + x^6$$

$$a^3 \cdot (a^5 + a^k) = a^3 \cdot a^5 + a^3 \cdot a^k = a^{3+5} + a^{3+k} = a^8 + a^{3+k}$$

$$3b^3 \cdot (4b^2 - 5b^5) = 3b^3 \cdot 4b^2 - 3b^3 \cdot 5b^5 = 12b^5 - 15b^8$$

$$a^m \cdot (a^{m+1} - a^{3m-7}) = a^m \cdot a^{m+1} - a^m \cdot a^{3m-7} = a^{m+m+1} - a^{m+3m-7} = a^{2m+1} - a^{4m-7}$$

$$y^{2a} \cdot (y^{3a+1} - y^{a-4}) = y^{2a} \cdot y^{3a+1} - y^{2a} \cdot y^{a-4} = y^{2a+3a+1} - y^{2a+a-4} = y^{5a+1} - y^{3a-4}$$

$$x^{n-3} \cdot (x^5 + x^4) = x^{n-3+5} + x^{n-3+4} = x^{n+2} + x^{n-3+4}$$

5.

$$(x^2 + x^3)^2 = x^4 + 2x^5 + x^6$$

$$(y^3 - y^4)^2 = y^6 - 2y^7 + y^8$$

$$(a^6 + a^4)^2 = a^{12} + 2a^{10} + a^8$$

$$(b^3 - b^7)^2 = b^6 - 2b^{10} + b^{14}$$

$$(2a^2 + 3a^3)^2 = 4a^4 + 12a^5 + 9a^6$$

$$(4x^5 - 2x^6)^2 = 16x^{10} - 16x^{11} + 4x^{12}$$

$$(6d^5 - 3d^4)^2 = 36d^{10} - 36d^9 + 9d^8$$

$$(3m^2 + 5m^3)^2 = 9m^4 + 30m^5 + 25m^6$$

6.

$$(a^2 + a^3)(a^2 - a^3) = a^4 - a^6$$

$$(x^5 + y^4)(x^5 - y^4) = x^{10} - y^8$$

$$(m^3 + n^5)(m^3 - n^5) = m^6 - n^{10}$$

$$(3x^4 + 2y^5)(3x^4 + 2y^5) = 9x^8 + 12x^4y^5 + 4y^{10}$$

$$(4y^3 + 6x^2)(4y^3 - 6x^2) = 16y^6 - 36x^4$$

$$(3a^4 + 4b^3)(3a^4 - 4b^3) = 9a^8 - 16b^6$$

7.

$$(a^3 + a^4)(a^2 + a^5) = a^3 \cdot a^2 + a^3 \cdot a^5 + a^4 \cdot a^2 + a^4 \cdot a^5 = a^5 + a^8 + a^6 + a^9$$

$$(x^2 - x^3)(x^3 + x^6) = x^2 \cdot x^3 + x^2 \cdot x^6 - x^3 \cdot x^3 - x^3 \cdot x^6 = x^5 + x^8 - x^6 - x^9 = x^5 - x^6 + x^8 - x^9$$

$$(a^3 - b^2)(a^5 + b^3) = a^8 + ab^3 - a^5b^2 - b^5$$

$$(y^4 + y^5)(y^3 - y^6) = y^7 - y^{10} + y^8 - y^{11}$$

$$(2a^5 + 3b^3)(2a^5 - 2b^3) = 4a^{10} - 4a^5b^3 + 6ab^3 - 6b^6$$

$$(k^m + k^n)(k^{m+1} + k^{n+2}) = k^{2m+1} + k^{m+n+2} + k^{m+n+1} + k^{2n+2}$$

8.

$$\begin{aligned} a) & x^{3+5} = x^3 \cdot x^5 \\ b) & a^{3n+2} = a^{3n} \cdot a^2 \\ c) & 5^{m+n} = 5^m \cdot 5^n \\ d) & z^{5k+3m} = z^{5k} \cdot z^{3m} \\ e) & x^{m+4} = x^m \cdot x^4 \end{aligned}$$

9.

$$\begin{aligned} a) & \frac{5^8}{5^3} = 5^8 \cdot \frac{1}{5^3} = 5^8 \cdot 5^{-3} \\ b) & \frac{8^9}{8^3} = 8^9 \cdot \frac{1}{8^3} = 8^9 \cdot 8^{-3} \\ c) & \frac{12^{13}}{12^5} = 12^{13} \cdot \frac{1}{12^5} = 12^{13} \cdot 12^{-5} \\ d) & \frac{a^9}{a^5} = a^9 \cdot \frac{1}{a^5} = a^9 \cdot a^{-5} \\ e) & \frac{y^8}{y^6} = y^8 \cdot \frac{1}{y^6} = y^8 \cdot y^{-6} \\ f) & \frac{k^{13}}{k^{19}} = k^{13} \cdot \frac{1}{k^{19}} = k^{13} \cdot k^{-19} \end{aligned}$$

10.

$$\begin{aligned} a) & \frac{a^x}{a^3} = a^x \cdot \frac{1}{a^3} = a^x \cdot a^{-3} \\ b) & \frac{x^y}{x} = x^y \cdot \frac{1}{x} = x^y \cdot x^{-1} \\ c) & \frac{x^{3m}}{x^m} = x^{3m} \cdot \frac{1}{x^m} = x^{3m} \cdot x^{-m} \\ d) & \frac{y^{6m}}{y^{3m}} = y^{6m} \cdot \frac{1}{y^{3m}} = y^{6m} \cdot y^{-3m} \\ e) & \frac{k^{2m}}{k^3} = k^{2m} \cdot \frac{1}{k^3} = k^{2m} \cdot k^{-3} \\ f) & \frac{d^{2p}}{d^2} = d^{2p} \cdot \frac{1}{d^2} = d^{2p} \cdot d^{-2} \end{aligned}$$

11.

$$\begin{aligned} a) & \frac{x^m}{x^{m-3}} = x^m \cdot \frac{1}{x^{m-3}} = x^m \cdot x^{-(m-3)} = x^m \cdot x^{-m+3} = x^3 \\ b) & \frac{a^{3m}}{a^{m-1}} = a^{3m} \cdot \frac{1}{a^{m-1}} = a^{3m} \cdot a^{1-m} = a^{2m+1} \\ c) & \frac{z^{3x}}{z^{x-4}} = z^{3x} \cdot \frac{1}{z^{x-4}} = z^{3x} \cdot z^{-x+4} = z^{2x+4} \\ d) & \frac{k^{4a}}{k^{2a+3}} = k^{4a} \cdot \frac{1}{k^{2a+3}} = k^{4a} \cdot k^{-2a-3} = k^{2a-3} \\ e) & \frac{y^{2b}}{y^{b+3}} = y^{2b} \cdot \frac{1}{y^{b+3}} = y^{2b} \cdot y^{-b-3} = y^{b-3} \\ f) & \frac{m^{4b}}{m^{2b+7}} = m^{4b} \cdot \frac{1}{m^{2b+7}} = m^{4b} \cdot m^{-2b-7} = m^{2b-7} \end{aligned}$$

12.

$$\begin{aligned} a) & \frac{x^{n+3}}{x^{n+2}} = x^{n+3} \cdot x^{-n-2} = x^1 = x \\ b) & \frac{a^{2n-1}}{a^{n-2}} = a^{2n-1} \cdot a^{-n+2} = a^{n+1} \\ c) & \frac{y^{3n+4}}{y^{n+2}} = y^{3n+4} \cdot y^{-n-2} = y^{2n+6} \\ d) & \frac{b^{5m+4}}{b^{3m+3}} = b^{5m+4} \cdot b^{-3m-3} = b^1 = b \\ e) & \frac{v^{7x+4}}{v^{5x-2}} = v^{7x+4} \cdot v^{-5x+2} = v^{2x+6} \\ f) & \frac{x^{3p+1}}{x^{p+1}} = x^{3p+1} \cdot x^{-p-1} = x^p \\ g) & \frac{z^{k+3x}}{z^{k+2x}} = z^{k+3x} \cdot z^{-k-2x} = z^x \\ h) & \frac{b^{3m-6}}{b^{m-5}} = b^{3m-6} \cdot b^{m+5} = b^{2m-1} \end{aligned}$$

13.

$$\begin{aligned} a) & (x^8 + x^6 - x^5) : x^2 = (x^8 + x^6 - x^5) \cdot x^{-2} = x^6 + x^4 - x^3 \\ b) & (15a^3 + 12a^6 - 3a^4) : 3a^2 = 15a^3 \cdot 3a^{-2} + 12a^6 \cdot 3a^{-2} - 3a^4 \cdot 3a^{-2} \\ & = 45a + 36a^4 - 9a^2 \\ c) & (21b^8 - 28b^4 + 14b^5) : 7b^{-3} = 147b^5 - 196b + 98b^2 \\ d) & (3x^{n+3} - 9x^{2n+4} + 12x^{n+5}) : 3x^{-2} = 9x^{n+7} - 27x^{2n+6} + 36x^{n+3} \\ e) & (35y^{m+2} - 20y^{2m+4} + 15y^{m+8}) : 5y^{-m} \\ & = 7y^{m+2} - 4y^{2m+4} + 3y^{m+8} \\ f) & (4z^{a+3} + 16z^{2a+5} - 12z^{a+4}) : 2z^{-a} \\ & = 8z^{2a+3} + 32z^{3a+5} - 6z^{2a+4} \end{aligned}$$