

Indices 1

1. Use the rule $a^m \times a^n = a^{m+n}$ to simplify each expression.

- (a) $a^4 \times a^3$ (b) $t^3 \times t^2$ (c) $y^4 \times y^4$ (d) $n^2 \times n^5$
(e) $p^3 \times p^3$ (f) $x^6 \times x^4$ (g) $m^4 \times m$ (h) $y^6 \times y^6$
(i) $z^4 \times z^2$ (j) $k^7 \times k$ (k) $c^2 \times c^7$ (l) $a^5 \times a^3 \times a^2$

2. Use the rule $a^m \div a^n = a^{m-n}$ to simplify each expression.

- (a) $a^7 \div a^2$ (b) $t^4 \div t^2$ (c) $u^5 \div u^2$ (d) $v^8 \div v^3$
(e) $w^6 \div w$ (f) $p^3 \div p^2$ (g) $k^7 \div k^3$ (h) $c^9 \div c^7$
(i) $d^5 \div d^4$ (j) $y^5 \div y$ (k) $z^6 \div z^2$ (l) $n^{10} \div n^4$

3. Simplify:

- (a) $a^2 \times a^3$ (b) $m^6 \div m^2$ (c) $y^3 \times y^6$ (d) $n^5 \div n^3$
(e) $p^3 \times p$ (f) $x^5 \times x^5$ (g) $v^8 \div v^5$ (h) $t^2 \times t$
(i) $a^2 \times a^5$ (j) $y^6 \div y^2$ (k) $\frac{x^8}{x^3}$ (l) $c^7 \times c^5$
(m) $k^9 \div k^4$ (n) $b \times b^6$ (o) $u^5 \times u^2$ (p) $\frac{a^{10}}{a^7}$
(q) $y^4 \div y$ (r) $a^3 \times a^6$ (s) $c^6 \div c^4$ (t) $x^8 \div x^7$

4. Simplify:

(a) $\frac{y^7 \times y^3}{y^6}$ (b) $\frac{a^5 \times a^2}{a^4}$ (c) $\frac{p^6 \times p^8}{p^5}$ (d) $\frac{y^7 \times y}{y^5}$
(e) $\frac{x^2 \times x^4}{x^5}$ (f) $\frac{a^3 \times a^3}{a^4}$ (g) $\frac{t^{10}}{t^2 \times t^5}$ (h) $\frac{m^5 \times m^3}{m^2 \times m^4}$

5. Multiply out the brackets and simplify:

(a) $x^3(x^2 + x^4)$ (b) $y^2(y^6 + y^2)$ (c) $a^5(a^3 + a)$ (d) $x^4(x^5 - x^3)$
(e) $y^6(y^2 + y^4)$ (f) $c^3(c^2 + c^7)$ (g) $w^2(w^5 - w^2)$ (h) $x(x^4 + x^2)$
(i) $a^3(a^3 + 1)$ (j) $k^7(k - k^3)$ (k) $y^5(y^3 + y)$ (l) $m^4(m^5 + m^2)$

6. Simplify:

(a) $3y^6 \times 2y^4$ (b) $2y^2 \times 4y^3$ (c) $5a^3 \times 2a^3$ (d) $5y^3 \times 4y^2$
(e) $\frac{8a^7}{2a^4}$ (f) $15c^8 \div 5c^2$ (g) $\frac{18x^{10}}{3x^8}$ (h) $2m^6 \times 6m^2$
(i) $10a^6 \div 2a^5$ (j) $\frac{6x^8}{2x^3}$ (k) $3x^7 \times 4x^3$ (l) $\frac{8c^8}{4c}$
(m) $2y^3 \times 5y$ (n) $6k^5 \times 2k^3$ (o) $\frac{6c^5}{2c^4}$ (p) $5y^2 \times 3y^4 \times 2y^2$
(q) $\frac{5y^2 \times 4y^8}{2y^3}$ (r) $\frac{9a^3 \times 2a^5}{3a^6}$

7. Use the rule $(a^m)^n = a^{mn}$ to simplify each expression.

- (a) $(a^2)^4$ (b) $(x^5)^2$ (c) $(p^3)^3$ (d) $(y^4)^5$
(e) $(t^3)^2$ (f) $(m^6)^5$ (g) $(u^2)^7$ (h) $(w^3)^6$
(i) $(b^5)^5$ (j) $(c^3)^4$ (k) $(y^8)^5$ (l) $(n^2)^{10}$

8. Use the rule $(ab)^m = a^m b^m$ to simplify each expression.

- (a) $(ab)^3$ (b) $(xy)^4$ (c) $(uv)^8$ (d) $(pq)^6$
(e) $(3x)^2$ (f) $(4y)^2$ (g) $(2a)^3$ (h) $(3t)^4$

9. Simplify:

- (a) $n^2 \times n^3$ (b) $p^4 \times p^4$ (c) $t^3 \times t$ (d) $u^5 \times u^2$
(e) $k^5 \div k^2$ (f) $y^4 \div y^3$ (g) $v^6 \div v^4$ (h) $w^5 \div w$
(i) $(a^2)^3$ (j) $(b^4)^2$ (k) $(c^3)^5$ (l) $(d^2)^6$
(m) $\frac{x^3 \times x^4}{x^2}$ (n) $\frac{y^5 \times y^2}{y}$ (o) $\frac{z^2 \times z^8}{z^3}$ (p) $\frac{t^3 \times t^6}{t^4}$
(q) $2a^2 \times 4a^3$ (r) $5x^2 \times 3x^4$ (s) $2y^2 \times 3y^2$ (t) $\frac{8y^7}{2y^4}$
(u) $10y^6 \div 2y^2$ (v) $\frac{6z^5}{3z}$ (w) $\frac{4y^6 \times 3y^2}{2y^5}$ (x) $\frac{2p^4 \times 9p}{6p^3}$

ANSWERS

1. (a) a^7 (b) t^5 (c) y^8 (d) n^7 (e) p^6 (f) x^{10}
(g) m^5 (h) y^{12} (i) z^6 (j) k^8 (k) c^9 (l) a^{10}
2. (a) a^5 (b) t^2 (c) u^3 (d) v^5 (e) w^5 (f) p
(g) k^4 (h) c^2 (i) d (j) y^4 (k) z^4 (l) n^6
3. (a) a^5 (b) m^4 (c) y^9 (d) n^2 (e) p^4 (f) x^{10}
(g) v^3 (h) t^3 (i) a^7 (j) y^4 (k) x^5 (l) c^{12}
(m) k^5 (n) b^7 (o) u^7 (p) a^3 (q) y^3 (r) a^9
(s) c^2 (t) x
4. (a) y^4 (b) a^3 (c) p^9 (d) y^3 (e) x (f) a^2
(g) t^3 (h) m^2
5. (a) $x^5 + x^7$ (b) $y^8 + y^4$ (c) $a^8 + a^6$ (d) $x^9 - x^7$
(e) $y^8 + y^{10}$ (f) $c^5 + c^{10}$ (g) $w^7 - w^4$ (h) $x^5 + x^3$
(i) $a^6 + a^3$ (j) $k^8 - k^{10}$ (k) $y^8 + y^6$ (l) $m^9 + m^6$
6. (a) $6y^{10}$ (b) $8y^5$ (c) $10a^6$ (d) $20y^5$ (e) $4a^3$ (f) $3c^6$
(g) $6x^2$ (h) $12m^8$ (i) $5a$ (j) $3x^5$ (k) $12x^{10}$ (l) $2c^7$
(m) $10y^4$ (n) $12k^8$ (o) $3c$ (p) $30y^8$ (q) $10y^7$ (r) $6a^2$
7. (a) a^8 (b) x^{10} (c) p^9 (d) y^{20} (e) t^6 (f) m^{30}
(g) u^{14} (h) w^{18} (i) b^{25} (j) c^{12} (k) y^{40} (l) n^{20}
8. (a) a^3b^3 (b) x^4y^4 (c) u^8v^8 (d) p^6q^6 (e) $9x^2$ (f) $16y^2$
(g) $8a^3$ (h) $81t^4$
9. (a) n^5 (b) p^8 (c) t^4 (d) u^7 (e) k^3 (f) y
(g) v^2 (h) w^4 (i) a^6 (j) b^8 (k) c^{15} (l) d^{12}
(m) x^5 (n) y^6 (o) z^7 (p) t^5 (q) $8a^5$ (r) $15x^6$
(s) $6y^4$ (t) $4y^3$ (u) $5y^4$ (v) $2z^4$ (w) $6y^3$ (x) $3p^2$