



Indices

Question 1 Simplify the following:

(a) $n^4 \times n =$

(b) $y^3 \times y \times y^6 =$

(c) $n^6 \div n =$

(d) $p^3 \times p^7 \div p^4 =$

(e) $\frac{m^6}{m^5} =$

(f) $(a^3)^4 =$

(g) $7n^5 \times 5n^7 =$

(h) $x^4 y^2 \times x^5 y^3 =$

(i) $4x^{10} y^6 \div 2x^5 y^3 =$

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(j) $(4pq^3)^5 =$

(k) $\frac{4m^2 \times 6m^7}{3m^6} =$

(l) $\left(\frac{3x^3 \times 4x^7}{x^3 \times 2x}\right)^2 =$

Question 2 Simplify the following:

(a) $(11x^7 y^3 z^{12})^2 =$

(b) $a^4 \times a^3 \div a^5 =$

(c) $x^{12} \div x^4 \times x^2 =$

(d) $m^{15} \div m^5 \div m^3 =$

(e) $15m^3 p^4 \times 6m^2 p^3 \div 10mp$

(f) $48x^9 y^6 \div 6x^4 y \div 4xy^3 =$

(g) $\frac{p^5 q^3 \times p^{12} q^6}{p^{10} q^4} =$

(h) $\frac{2m^4 n^7 \times 12mn^3}{6m^2 n^4} =$

(i) $\frac{15x^9 y \times 8xy^{11}}{4x^3 y^8 \times 3x^2 y} =$

Question 3 Simplify the following:

(a) $3^x \times 3^x =$

(b) $5^x \times 5^{11} =$

(c) $5^m \times 5^{m+1} =$

(d) $3^x \div 3^y =$

(e) $2^{5n} \div 2^{2n+1} =$

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

(g) $\frac{m^5}{12n^2} \times \frac{3n^4}{2m^2} =$

(h) $\frac{(a+b)^4}{x^{11}} \div \frac{(a+b)}{3x^5} =$

(i) $\frac{m^6(m^2+5)}{n^5} \times \frac{n^3(n-3)}{m(m^2+5)^3} =$

Question 4 Simplify the following and express in positive index form:

a) $a^3 \times a^{-5} =$

(b) $x^7 \times x^{-3} =$

(c) $(n^{-3})^5 =$

d) $(2p^{-4})^{-3} =$

(e) $3x^{-2} \times x^{-7} =$

(f) $5a^2 b^{-11} \times 3a^{-3} b^7 =$

Question 5 Evaluate the following without using a calculator:

a) $16^{\frac{1}{4}} =$

(b) $8^{\frac{2}{3}} =$

(c) $1000^{\frac{2}{3}} =$

d) $125^{\frac{4}{3}} =$

(e) $(9^{\frac{1}{2}})^3 =$

(f) $25^{-\frac{1}{2}} =$

g) $16^{-\frac{3}{4}} =$

(h) $32^{\frac{3}{5}} =$

(i) $216^{-\frac{1}{3}} =$

Question 6 Simplify the following:

(a) $p^{\frac{5}{3}} \times p^{\frac{7}{3}} =$

(b) $m^{\frac{3}{4}} + m^{\frac{1}{4}} =$

(c) $12n^2 + 3n^{\frac{1}{2}} =$

(d) $2p^{\frac{3}{4}} \times 6p^{\frac{3}{8}} + 3p^{-\frac{7}{8}} =$

(e) $m^{-\frac{5}{6}} + m^{\frac{1}{3}} =$

(f) $(a^{\frac{1}{3}})^6 =$

(g) $(32n^5)^{\frac{2}{5}} =$

(h) $(m^9 n^6)^{\frac{1}{3}} =$

(i) $(8a^{12} b^{15})^{\frac{2}{3}} =$

Question 7 Evaluate the following without using a calculator:

(a) $625^{\frac{1}{4}} =$

(b) $243^{\frac{1}{5}} =$

(c) $1000^{-\frac{1}{3}} =$

(d) $64^{-\frac{2}{3}} =$

(e) $729^{\frac{1}{3}} =$

(f) $(0.25)^{\frac{3}{2}} =$

(g) $(0.04)^{-\frac{1}{2}} =$

(h) $(0.216)^{\frac{2}{3}} =$

(i) $(\frac{64}{125})^{\frac{4}{3}} =$

(j) $(\frac{16}{81})^{\frac{3}{4}} =$

(k) $(\frac{32}{243})^{-\frac{4}{5}} =$

(l) $(\frac{216}{64})^{-\frac{4}{3}} =$

Question 8 Expand and simplify the following:

(a) $a^2(a^3 + 2) =$

(b) $x^2(x^2 - 5) =$

(c) $n^2(n^3 + 3n) =$

(d) $5p^3(2p^4 - 3p) =$

(e) $x^2(2x^3 - 3y^2) =$

(f) $7mn(5m^2 + 2n) =$

(g) $(a^3 + 1)(a^3 - 1) =$

(h) $(x^2 + 3)(x^2 - 1) =$

(i) $(3m^2 - n^2)(2m^2 + 5n^2)$

Question 9

(a) Express $m^{-1} + n^{-1}$ as a single fraction without negative indices.

(b) Simplify $\frac{x^2 - y^2}{x^{-2} - y^{-2}}$

14 Indices (ANSWERS)

- 1 (a) n^5 (b) y^{10} (c) n^5
 (d) p^6 (e) m (f) a^{12}
 (g) $35n^{12}$ (h) x^9y^5 (i) $2x^5y^3$
 (j) $1024p^5q^{15}$ (k) $8m^3$ (l) $36x^{12}$
- 2 (a) $121x^{14}y^6z^{24}$ (b) a^2 (c) x^{10}
 (d) m^7 (e) $9m^4p^6$ (f) $2x^4y^2$
 (g) p^7q^5 (h) $4m^3n^6$ (i) $10x^5y^3$
- 3 (a) 3^{2x} (b) 5^{x+11} (c) 5^{2m+1}
 (d) 3^{x-y} (e) 2^{3n-1} (f) a^{m+3}
 (g) $\frac{m^3n^2}{8}$ (h) $\frac{3(a+b)^3}{x^6}$ (i) $\frac{m^5(n-3)}{n^2(m^2+5)^2}$
- 4 (a) $\frac{1}{a^2}$ (b) x^4 (c) $\frac{1}{n^{15}}$
 (d) $\frac{p^{12}}{8}$ (e) $\frac{3}{x^9}$ (f) $\frac{15}{ab^4}$
- 5 (a) 2 (b) 4 (c) 100
 (d) 625 (e) 27 (f) 0.2
 (g) 0.1 (h) 8 (i) 0.17

- 6 (a) p^4 (b) $m^{1/2}$ (c) $4n^{3/2}$
 (d) $4p^2$ (e) $m^{-7/6}$ (f) a^2
 (g) $4n^2$ (h) m^3n^2 (i) $4a^8b^{10}$
- 7 (a) 5 (b) 3 (c) 0.1 or $\frac{1}{10}$
 (d) 0.06 or $\frac{1}{16}$ (e) 9 (f) 0.13 or $\frac{1}{8}$
 (g) 5 (h) 0.36 (i) ~~$\frac{1}{10}$~~ $\frac{256}{625}$
 (j) 0.59 or $\frac{8}{27}$ (k) 6.06 or $\frac{81}{16}$ (l) 0.2 or $\frac{16}{81}$
- 8 (a) $a^5 + 2a^2$ (b) $x^4 - 5x^2$
 (c) $n^5 + 3n^3$ (d) $10p^7 - 15p^4$
 (e) $2x^5 - 3x^2y^2$ (f) $35m^3n + 14mn^2$
 (g) $a^6 - 1$ (h) $x^4 + 2x^2 - 3$
 (i) $6m^4 + \frac{18n^3}{13m^2n^2} - 5n^4$
- 9 (a) $\frac{n+m}{nm}$ (b) $-x^2y^2$