

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

Question 1:

Simplify $\left(\frac{a}{b^3}\right)^{-2} \times (4a^2b^4)^{\frac{1}{2}}$, expressing your answer in positive indices.

$$= \frac{a^{-2}}{b^{-6}} \times 2ab^2$$

$$= \frac{b^6}{a^2} \times 2ab^2$$

$$= \frac{2b^8}{a}$$

Question 2:

Solve the equation $9^{2x-1} = 27^x$.

$$3^{4x-2} = 3^{3x}$$

By comparing power,

$$4x - 2 = 3x$$

$$x = 2$$

Question 3:

Solve the following equations:

a) $5 \times 5^{2n-2} = 125$

b) $\left(\frac{1}{3^x}\right)^2 = \sqrt{27}$

a) $5^{2n-1} = 5^3$

By comparing power,

$$2n - 1 = 3$$

$$2n = 4$$

$$n = 2$$

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

$$b) \frac{1}{3^{2x}} = (3^3)^{\frac{1}{2}}$$

$$3^{-2x} = 3^{\frac{3}{2}}$$

By comparing power,

$$-2x = \frac{3}{2}$$

$$x = -\frac{3}{4}$$

Question 4:

Simplify $x^{\frac{4}{3}} \div \sqrt[3]{x^2}$

$$= x^{\frac{4}{3}} \div x^{\frac{2}{3}}$$

$$= x^{\frac{2}{3}}$$

Question 5:

Simplify the following, expressing your answers in positive index notation whenever possible.

a) $(2m^2)^3$,

b) $1 \div 5n^{-3}$,

c) $p^n \times p^{-n}$,

d) $\frac{\sqrt[3]{t^4}}{t}$.

a) $8m^6$

b) $= \frac{1}{5n^{-3}}$

$= \frac{n^3}{5}$

c) 1

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

$$\begin{aligned}d) &= \frac{t^{\frac{4}{3}}}{t} \\ &= t^{\frac{1}{3}}\end{aligned}$$

Question 6:

Solve

$$a) 5^{-4} \times 125^p = 15^0,$$

$$b) 4 \times 10^{3f-2} = 0.004$$

$$a) 5^{-4} \times 5^{3p} = 5^0$$

$$5^{-4+3p} = 5^0$$

By comparing power,

$$-4 + 3p = 0$$

$$p = \frac{4}{3}$$

$$b) 4 \times 10^{3f-2} = 4 \times 10^{-3}$$

By comparing power,

$$3f - 2 = -3$$

$$3f = -1$$

$$f = -\frac{1}{3}$$

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

Question 7:

Simplify $\frac{3x^2}{z^2} \div \frac{9x}{14yz}$

$$\left(\frac{3x^2}{z^2}\right) \times \frac{14yz}{9x}$$

$$= \frac{14xy}{3z}$$

Question 8:

Solve for n if $\frac{x^{2n}}{x^{-3}} = \sqrt{x} \times x^5$.

$$x^{2n+3} = x^{\frac{11}{2}}$$

By comparing power,

$$2n + 3 = \frac{11}{2}$$

$$n = \frac{5}{4}$$

Question 9:

Solve $x^{\frac{2}{3}} = 5$.

$$\sqrt[3]{x^2} = 5$$

$$x^2 = 5^3$$

$$x = \pm\sqrt{5^3}$$

$$x = \pm 11.2$$

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

Question 10:

Simplify each of the following and express your answers in positive indices.

a) $(-2x^{-1})^{-3}$

b) $\frac{p^3}{q^{-4}} \div \left(\frac{3p}{2q}\right)^2$

$$\begin{aligned} \text{a)} &= \frac{1}{(-2x^{-1})^{-3}} \\ &= \frac{1}{-8x^3} \end{aligned}$$

$$\begin{aligned} \text{b)} &= p^3 q^4 \times \frac{4q^2}{9p^2} \\ &= \frac{4pq^6}{9} \end{aligned}$$

Question 11:

Given that $8^n = 4$, find the value of n .

$$2^{3n} = 2^2$$

By comparing power,

$$3n = 2$$

$$n = \frac{2}{3}$$

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

Question 12:

Given that $5^m = p$ and $7^m = q$, express the following in terms of p and/or q .

a) 5^{1-m}

b) 35^m

c) $\left(\frac{7^{-1}}{25}\right)^m$

a) 5^{1-m}

$= 5(5^{-m})$

$= \frac{5}{5^m}$

$= \frac{5}{p}$

b) 35^m

$= 5^m 7^m$

$= pq$

c) $\left(\frac{7^{-1}}{25}\right)^m$

$= \frac{7^{-m}}{5^{2m}}$

$= \frac{1}{7^m (5^m)^2}$

$= \frac{1}{qp^2}$

Question 13:

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

Without the use of a calculator and showing your workings clearly, evaluate $9^{\frac{3}{8}} \times \sqrt{3^{\frac{1}{2}}}$

$$\begin{aligned} & 9^{\frac{3}{8}} \times \sqrt{3^{\frac{1}{2}}} \\ &= (3^2)^{\frac{3}{8}} \times \left(3^{\frac{1}{2}}\right)^{\frac{1}{2}} \\ &= 3^{\frac{3}{4}} \times 3^{\frac{1}{4}} \\ &= 3 \end{aligned}$$

Question 14:

a) Simplify $-2\frac{2}{3} \div \frac{16df^3}{3d^2e}$

b) Simplify $a^4 \times a \div \sqrt[3]{a}$ and give your answer in the form a^n .

$$\begin{aligned} \text{a) } & -\frac{8}{3} \times \frac{3d^2e}{16df^3} \\ &= -\frac{de}{2f^3} \end{aligned}$$

$$\begin{aligned} \text{b) } & a^4 \times a \div a^{\frac{1}{3}} \\ &= a^{\frac{14}{3}} \end{aligned}$$

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

Question 15:

Given $4^2 \div 8^{2x} = \frac{1}{64}$, find the value of x .

$$2^2 \div 2^{6x} = 2^{-6}$$

$$2^{2-6x} = 2^{-6}$$

$$2 - 6x = -6$$

$$x = \frac{4}{3}$$

Question 16:

a) Given that $25 \times \frac{1}{125} = 5^m$, find the value of m .

b) Simplify $9x^2y^3 \div 6x^4y^{-2}$

c) $\left(\frac{z^6}{27}\right)^{-\left(\frac{1}{3}\right)}$

$$a) \frac{1}{5} = 5^m$$

$$m = -1$$

b) $\frac{9x^2y^3}{6x^4y^{-2}}$

$$= \frac{3y^5}{2x^2}$$

c) $\left(\frac{27}{z^6}\right)^{\frac{1}{3}}$

$$= \frac{3}{z^2}$$

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

Question 17:

Simplify $6k^0 + \sqrt{k} \times \sqrt{k} \times k^2$.

$$= 6 + k^{\frac{1}{2}} \times k^{\frac{1}{2}} \times k^2$$

$$= 6 + k^3$$

Question 18:

Simplify $(\sqrt[3]{3a^2b^{-3}})^3 \times \left(\frac{a^{-3}b}{-2}\right)^2$, leaving your answer in positive index.

$$= 3a^6b^{-9} \times \left(\frac{a^{-6}b^2}{4}\right)$$

$$= \frac{3a^6}{b^9} \times \frac{b^2}{4a^6}$$

$$= \frac{3}{4b^7}$$

Question 19:

Simplify the following expressions and give your answers in positive index notation.

a) $(3a^0 + 2)^0 - 1$

b) $(2b^{-2})^{-3}$

a) $1 - 1 = 0$

b) $2^{-3}b^6$

$$= \frac{1}{8}b^6$$

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

Question 20:

$$\text{Solve } (3^{\frac{1}{2}})^{4+2x} = \frac{27}{3^x}$$

$$3^{2+x} = \frac{3^3}{3^x}$$

$$3^{2+x} = 3^{3-x}$$

$$2 + x = 3 - x$$

$$2x = 1$$

$$x = \frac{1}{2}$$

Question 21:

If $27a^{3x} = 1$ and $a > 0$, find $a^{2x} - a^{-x}$.

$$(3a^x)^3 = 1$$

$$3a^x = 1$$

$$a^x = \frac{1}{3}$$

$$a^{2x} = \frac{1}{9}$$

$$a^{2x} - a^{-x}$$

$$= a^{2x} - \frac{1}{a^x}$$

$$= \frac{1}{9} - 3$$

$$= -\frac{26}{9}$$

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

Question 22:

a) Simplify $x^{\frac{1}{2}} \times \left(\frac{1}{\sqrt{x}}\right)^{-1}$

b) Given that $(x^2 y^p \div x^q y^4)^3 = x^3$, find the values of p and q .

a) $x^{\frac{1}{2}} \times x^{\frac{1}{2}}$

$= x$

b) $(x^{2-q} y^{p-4})^3 = x^3$

$x^{6-3q} y^{3p-12} = x^3$

By comparing power,

$6 - 3q = 3$

$q = 1$

$3p - 12 = 0$

$p = 4$

Question 23:

Solve the equation $81^{3x-2} = \left(\frac{1}{27}\right)^{x-1}$

$3^{12x-8} = 3^{-3x+3}$

By comparing power,

$12x - 8 = -3x + 3$

$15x = 11$

$x = \frac{11}{15}$

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

Question 24:

Simplify $qp^3 \times (q^2)^3 \div p^2$, expressing your answer in the form $p^a q^b$.

$$= qp^3 \times q^6 \div p^2$$

$$= pq^7$$

Question 25:

a) Given that $\frac{1}{8} = 2^k$, find k .

b) Given that $9 \times 27^{\frac{1}{5}} = 3^n$, find n .

c) Solve the equation $27^{x+\frac{1}{3}} - 1 = 0$.

$$a) 2^{-3} = 2^k$$

$$k = -3$$

$$b) 3^2 \times 3^{\frac{3}{5}} = 3^n$$

$$3^{\frac{13}{5}} = 3^n$$

$$n = \frac{13}{5}$$

$$c) 3^{3x+1} = 1$$

$$3^{3x+1} = 3^0$$

$$3x + 1 = 0$$

$$x = -\frac{1}{3}$$

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

Question 26:

a) Simplify $\frac{(5x)^0 \times \sqrt{x^{12}}}{5x^{-3}}$

b) Given $\frac{243}{27^2} = 9$, find the value of p .

a) $\frac{1 \times x^6}{5x^{-3}}$

$= \frac{x^9}{5}$

b) $\frac{3^5}{3^{\frac{3p}{2}}} = 3^2$

$3^{5-\frac{3p}{2}} = 3^2$

$5 - \frac{3p}{2} = 2$

$10 - 3p = 4$

$p = 2$

Question 27:

Express the following as a power of 5:

a) $\frac{1}{25}$

b) 1

c) $\sqrt{5}$

a) 5^{-2}

b) 5^0

c) $5^{\frac{1}{2}}$

Question 28:

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

Simplify the following

a) $(3x)^2 \times (2x^3y^2)^0$

b) $\left(\frac{1}{x}\right)^{-3} + 7x^3$

c) Solve $3^{2q} \times 27^q = 729$

a) $9x^2$

b) $x^3 + 7x^3$

$= 8x^3$

c) $3^{2q} \times 3^{3q} = 3^6$

$3^{5q} = 3^6$

$5q = 6$

$q = \frac{6}{5}$

EQUITY

LEARNING PLACE

Elementary Math Topical (Indices)

Question 29:

a) Solve the equation $\frac{3^{\frac{x}{2}}}{9} = \frac{1}{\sqrt{27^x}}$.

b) Simplify $\frac{4}{b^2 a^{-2}} \div \frac{2a}{b^3}$, expressing your answer in positive indices.

$$\text{a) } \frac{3^{\frac{x}{2}}}{3^2} = \frac{1}{(3^{3x})^{\frac{1}{2}}}$$

$$3^{\frac{x}{2}-3} = 3^{-\frac{3x}{2}}$$

$$\frac{x}{2} - 3 = -\frac{3x}{2}$$

$$2x = 3$$

$$x = \frac{3}{2}$$

$$\text{b) } \frac{4a^2}{b^2} \times \frac{b^3}{2a}$$

$$= 2ab$$

Question 30:

Solve for x if $5^9 \div 625 = (\sqrt{5})^x$.

$$5^9 \div 5^4 = 5^{\frac{1}{2}x}$$

$$5 = \frac{1}{2}x$$

$$x = 10$$