

1. Use exponent laws to simplify each expression:

a) $3^4 \times 3^5$
 3^9

b) $\frac{x^6}{x^2}$
 x^4

c) $(5^2)^3$
 5^6

d) $(ab)^5$
 $a^5 b^5$

e) $(-3x^2y^7)(2xy^3)$
 $-6x^3y^{10}$

f) $\frac{15a^6b^7}{3ab^4}$
 $5a^5b^3$

g) $(3q^3)^4$
 $81q^{12}$

h) $(5x^2y^3)^2(2xy)^3$
 $(25x^4y^6)(8x^3y^3)$
 $200x^7y^9$

i) $\frac{(a^9b^7)^2}{(a^4b)^3}$
 $\frac{a^{18}b^{14}}{a^{12}b^3}$
 a^6b^{11}

j) 15^0
 1

k) -15^0
 -1

2. Use a factor tree to state the prime factorization of each number:

a) 54
Factor tree: 54 → 6 × 9 → 2 × 3 × 3 × 3
 $2 \cdot 3 \cdot 3 \cdot 3$

b) 42
Factor tree: 42 → 6 × 7 → 2 × 3 × 7
 $2 \cdot 3 \cdot 7$

c) 210
Factor tree: 210 → 21 × 10 → 3 × 7 × 2 × 5
 $2 \cdot 3 \cdot 5 \cdot 7$

3. Use the prime factorization to determine the GCF and LCM of each group of numbers:

a) 54 & 42
 $2 \cdot 3 \cdot 3 \cdot 3$
 $2 \cdot 3 \cdot 7$

$\underline{GCF} = 2 \cdot 3 = 6$

$\underline{LCM} = 2 \cdot 3 \cdot 3 \cdot 3 \cdot 7 = 378$

b) 42 & 210
 $2 \cdot 3 \cdot 7$
 $2 \cdot 3 \cdot 5 \cdot 7$

$\underline{GCF} = 2 \cdot 3 \cdot 7 = 42$

$\underline{LCM} = 2 \cdot 3 \cdot 5 \cdot 7 = 210$

c) 54, 42 & 210
 $2 \cdot 3 \cdot 3 \cdot 3$
 $2 \cdot 3 \cdot 7$
 $2 \cdot 3 \cdot 5 \cdot 7$

$\underline{GCF} = 2 \cdot 3 = 6$

$\underline{LCM} = 2 \cdot 3 \cdot 3 \cdot 3 \cdot 5 \cdot 7 = 1890$

4. Use the prime factorizations given to determine if each number represented is a perfect square, perfect cube, both or neither. Determine (using the prime factorization) any square root or cube root value as appropriate.

a) $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 5 \times 5 \times 5 = 2^6 3^3 5^3$

$\underline{2 \cdot 2 \cdot 3 \cdot 5} \quad \underline{2 \cdot 2 \cdot 3 \cdot 5} \quad \underline{2 \cdot 2 \cdot 3 \cdot 5}$

Perfect cube

$\sqrt[3]{} = 2 \cdot 2 \cdot 3 \cdot 5 = \boxed{60}$

b) $2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 = 2^2 3^6 7^6$

$\underline{2 \cdot 3 \cdot 3 \cdot 3 \cdot 7 \cdot 7 \cdot 7} \quad \underline{2 \cdot 3 \cdot 3 \cdot 3 \cdot 7 \cdot 7 \cdot 7}$

Perfect square

$\sqrt{} = 2 \cdot 3 \cdot 3 \cdot 3 \cdot 7 \cdot 7 \cdot 7 = \boxed{18522}$

c) $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 2^6 \cdot 3^{12}$

Perfect Square

$\sqrt{2^6 \cdot 3^{12}} = 2^3 \cdot 3^6 = \boxed{5832}$

Perfect cube

$\sqrt[3]{2^6 \cdot 3^{12}} = 2^2 \cdot 3^4 = \boxed{324}$

d) $5 \times 5 \times 5 \times 7 \times 7 = 5^3 \cdot 7^2$

Neither

5. Determine each root:

a) $\sqrt{169x^2y^{10}}$

$\boxed{13xy^5}$

b) $\sqrt[3]{125x^6y^9}$

$\boxed{5x^2y^3}$

c) $\frac{\sqrt{25a^{16}}}{\sqrt[4]{81b^{12}}}$

$\boxed{\frac{5a^8}{3b^3}}$

6. A cube has volume 216 cm^3 . Determine the surface area of the cube.

Let x
= side length
of cube

$V = x^3 = 216$

$x = \sqrt[3]{216}$
 $x = 6 \text{ cm}$

$SA = 6x^2 = 6(6)^2$

$= \boxed{216 \text{ cm}^2}$

7. The surface area of a cube is 864 m^2 . Determine the diagonal distance across one face of the cube.

$\frac{6x^2}{6} = \frac{864}{6}$

$x^2 = 144$

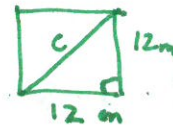
$x = \sqrt{144}$
 $x = 12$

$12^2 + 12^2 = c^2$

$288 = c^2$

$\sqrt{288} = c$

$\boxed{c = 16.97 \text{ m}}$



8. Write each expression with positive exponent:

a) x^{-5}

$\boxed{\frac{1}{x^5}}$

b) $(-5)^{-3}$

$\boxed{\frac{1}{(-5)^3}}$

c) $\frac{1}{q^{-6}}$

$\boxed{q^6}$

d) $\left(\frac{5}{4}\right)^{-4}$

$\boxed{\left(\frac{4}{5}\right)^4}$

e) $(3x)^{-3}$

$$\boxed{\frac{1}{(3x)^3}}$$

f) $3x^{-3}$

$$\boxed{\frac{3}{x^3}}$$

g) a^5b^{-7}

$$\boxed{\frac{a^5}{b^7}}$$

h) $\frac{-5a^2b^{-4}c^{-1}}{2d^{-3}e^5}$

$$\boxed{\frac{-5a^2d^3}{2b^4ce^5}}$$

9. Simplify each expression:

a) $(x^{-3})(x^5)$

$$\boxed{x^2}$$

c) $\frac{5^{-4}}{5^{-7}}$

$$\boxed{5^3}$$

e) $(m^3)^{-2}$

$$= \frac{m^{-6}}{1} = \boxed{\frac{1}{m^6}}$$

g) $(2x^{-3}y^4)^{-2}$

$$2^{-2}x^6y^{-8} = \boxed{\frac{2^6}{4y^8}}$$

b) $(y^5)(y^{-7})$

$$y^{-2} = \boxed{\frac{1}{y^2}}$$

d) $\frac{(-3)^4}{(-3)^7}$

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

f) $(n^{-3})^{-4}$

$$\boxed{n^{12}}$$

h) $\left(\frac{k^8}{k^{-2}}\right)^3$

$$(k^{10})^3 = \boxed{k^{30}}$$

10. Simplify then evaluate each expression (no decimal answers):

a) $(0.75^2)^{-3}$

$$\left(\frac{3}{4}\right)^{-6} = \left(\frac{4}{3}\right)^6 = \frac{4^6}{3^6} = \boxed{\frac{4096}{729}}$$

b) $[3^3 \times 3^{-5}]^2$

$$[3^{-2}]^2 = 3^{-4} = \boxed{\frac{1}{3^4}}$$

c) $\left[\frac{(-2)^{-10}}{(-2)^{-8}}\right]^{-3}$

$$[(-2)^{-2}]^{-3} = \boxed{(-2)^6}$$

11. A colony of beetles has a current population of 48,600 and triples every year.

a) Write a formula that will determine the population P after n number of years.

$$\boxed{P = 48600(3)^n}$$

b) Use your formula to determine the number of beetles in 7 years.

$$P = 48600(3)^7 = \boxed{106,288,200}$$

c) Use your formula to determine the number of beetles 5 years ago

$$P = 48600(3)^{-5} = \frac{48600}{3^5} = \boxed{200}$$

