

# Worksheet 6

Q1: Find the exact values of:

$\sqrt[3]{8} = 2$	$\sqrt{-27} = -3$
$\sqrt[3]{\frac{1}{8}} = \frac{1}{2}$	$\sqrt{\frac{-8}{64}} = \frac{-2}{4} = -\frac{1}{2}$
$\sqrt[3]{5} \times \sqrt[3]{25} =$ $\sqrt[3]{5 \times 25} = \sqrt[3]{5 \times 5 \times 5}$ $= 5$	$\sqrt[3]{\frac{3}{8}} = \sqrt[3]{\frac{27}{8}} = \frac{3}{2}$

Q2: Find x:

$\sqrt{x^2} = \sqrt{\frac{4}{81}} \quad x = \pm \frac{2}{9}$	$\frac{2x^2}{2} = \frac{200}{2}$ $\sqrt{x^2} = \sqrt{100} \quad x = \pm 10$
$\sqrt[3]{x^3} = \sqrt[3]{8}$ $x = 2$	$\sqrt[3]{x^3} = \sqrt[3]{-27}$ $x = -3$
$\sqrt[5]{x^3} = \sqrt[5]{0}$ $x = 0$	$2x^3 - 50 = 200$ $\quad \quad \quad +50 \quad +50$ $\frac{2}{2}x^3 = \frac{250}{2}$ $\sqrt[3]{x^3} = \sqrt[3]{125}$ $x = 5$

Q3: Find the exact values of:

$$9^{\frac{1}{2}} \times 8^{\frac{1}{3}} = \sqrt{9} \times \sqrt[3]{8}$$

$$= 3 \times 2 = 6$$

$$16^{\frac{3}{2}} = (\sqrt{16})^3 = 4^3 = 64$$

$$8^{-\frac{2}{3}} = \frac{1}{8^{\frac{2}{3}}} = \frac{1}{(\sqrt[3]{8})^2} = \frac{1}{2^2} = \frac{1}{4}$$

$$\left(\frac{3}{4}\right)^{-2} = \left(\frac{4}{3}\right)^2 = \frac{16}{9}$$

$$\sqrt{(2 \times 2 \times 3 \times 3 \times 5 \times 5)} = 30$$

$$\begin{array}{c} \downarrow \quad \downarrow \quad \downarrow \\ 2 \times 3 \times 5 \end{array}$$

Q4: Find the exact values of:

$$a^{\frac{1}{2}} \times a^{\frac{1}{2}} = a^1 = a \quad (\text{add powers})$$

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

$$a^{\frac{1}{4}} \times a^{\frac{1}{4}} \times a^{\frac{1}{4}} \times a^{\frac{1}{4}} = a^1 = a$$

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

$$\frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{3}{3} = 1$$

$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{4}{4} = 1$$

Q5: Find the exact values of:

a) $64^{\frac{1}{3}}$ $\sqrt[3]{64} = 4$	b) $125^{\frac{1}{3}}$ $\sqrt[3]{125} = 5$	c) $25^{\frac{3}{2}}$ $(\sqrt{25})^3 = 5^3 = 125$
d) $8^{\frac{5}{3}}$ $(\sqrt[3]{8})^5 = 2^5 = 32$	e) $16^{\frac{3}{4}}$ $(\sqrt[4]{16})^3 = 2^3 = 8$	f) $4^{-3}$ $\frac{1}{4^3} = \frac{1}{64}$
g) $4^{-\frac{1}{2}}$ $\frac{1}{4^{\frac{1}{2}}} = \frac{1}{\sqrt{4}} = \frac{1}{2}$	h) $27^{-\frac{2}{3}}$ $\frac{1}{27^{\frac{2}{3}}} = \frac{1}{(\sqrt[3]{27})^2} = \frac{1}{3^2} = \frac{1}{9}$	i) $9^{-\frac{1}{2}} \times 2^3$ $\frac{1}{9^{\frac{1}{2}}} \times 2^3 = \frac{1}{\sqrt{9}} \times 2^3 = \frac{1}{3} \times 8 = \frac{8}{3}$
j) $(3e)^0 = 1$	k) $8^{-\frac{2}{3}} = \frac{1}{8^{\frac{2}{3}}} = \frac{1}{(\sqrt[3]{8})^2} = \frac{1}{2^2} = \frac{1}{4}$	l) $\left(\frac{25}{16}\right)^{\frac{3}{2}} = \left(\frac{16}{25}\right)^{\frac{3}{2}}$ $(\sqrt{\frac{16}{25}})^3 = \left(\frac{4}{5}\right)^3 = \frac{64}{125}$
m) $\left(\frac{8}{27}\right)^{-\frac{2}{3}} = \left(\frac{27}{8}\right)^{\frac{2}{3}}$ $(\sqrt[3]{\frac{27}{8}})^2 = \left(\frac{3}{2}\right)^2 = \frac{9}{4}$	n) $(\sqrt{3})^2 = 3$	o) $\sqrt{2^4 \times 9}$ $\downarrow \quad \downarrow$ $2^2 \times 3 = 12$

Q6: Simplify  $\left(\frac{64x^6}{25y^2}\right)^{\frac{1}{2}} = \left(\frac{25y^2}{64x^6}\right)^{\frac{1}{2}} = \sqrt{\frac{25y^2}{64x^6}} = \frac{5y}{8x^3}$

$$\sqrt{x^6} = x^3$$

Q7: a) Simplify, leaving your answer in index form

i)  $4^7 \times 4 = 4^8$     ii)  $6^3 \div 6^5 = 6^{-2} = \frac{1}{6^2}$

b)  $7^y = 1$

Find the value of  $y$ .

$$7^y = 1$$

$$7^0 = 1 \Rightarrow y = 0$$

Q8: Evaluate the following.

Give your answers as fractions.

a)  $3^{-4}$

$$a) 3^{-4} = \frac{1}{3^4} = \frac{1}{81}$$

b)  $\sqrt[3]{\left(\frac{8}{27}\right)^2}$

$$b) \left(\sqrt[3]{\frac{8}{27}}\right)^2 = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$$

c)  $\left(\frac{\sqrt{6}}{4}\right)^4$

$$c) \left(\frac{\sqrt{6}}{4}\right)^4 = \frac{6^2}{4^4} = \frac{36}{256}$$

$$(\sqrt{6})^4 = (\sqrt{6} \times \sqrt{6} \times \sqrt{6} \times \sqrt{6})$$

$$6 \times 6 = 36$$

or  $(6^{\frac{1}{2}})^4 = 6^2$      $\boxed{\frac{1}{2} \times 4 = 2}$

Q9: a) Find, as a fraction, the value of  $\frac{4+2^3}{(4+2)^2}$

b) Write your answer to part a) as a decimal.

$$a) \frac{4+8}{6^2} = \frac{12}{36} = \frac{1}{3}$$

$$b) \frac{1}{3} = 0.\dot{3}$$

Q10:  $3^n = \frac{1}{9}$

Find the value of  $n$ .

$$3^n = \frac{1}{9}$$

$$3^n = \frac{1}{3^2}$$

$$3^n = 3^{-2} \Rightarrow \boxed{n = -2}$$

or  $3^n = \frac{1}{9}$

$$\frac{1}{3^{-n}} = \frac{1}{3^2}$$

$$-n = 2$$

$$\boxed{n = -2}$$

Q11:  $3 \times \sqrt{27} = 3^n$

Find the value of  $n$ .

add  
powers

$$\Rightarrow 3 \times 3^{\frac{3}{2}} = 3^n$$

$$3^{\frac{5}{2}} = 3^n$$

$$\boxed{n = \frac{5}{2}}$$

$$* \sqrt{27} = (27)^{\frac{1}{2}}$$

$$27 = 3^3$$

$$(27)^{\frac{1}{2}} = (3^3)^{\frac{1}{2}} = 3^{\frac{3}{2}}$$

$$* 1 + \frac{3}{2} = \frac{2}{2} + \frac{3}{2} = \frac{5}{2}$$

Q12: a) Simplify, leaving your answer in index form

i)  $5^4 \times 5^8$       ii)  $9^7 \div 9^4$

b) Solve  $\frac{3^8 \times 3^5}{3^n} = 3^4$

a) i)  $\Rightarrow 5^{12}$

ii)  $\Rightarrow 9^3$

b)  $\frac{3^8 \times 3^5}{3^n} = 3^4$

$$\frac{3^{13}}{3^n} = 3^4$$

$$3^{13-n} = 3^4$$

$$13-n = 4$$

$$\boxed{n = 9}$$