

## Solutions to Revision Sheet on Indices

1. a.  $x^4 \times x^3 = x^7$   
 b.  $y^5 \times y^2 = y^7$   
 c.  $p^3 \times p = p^4$   
 d.  $x^7 \times x^{-3} = x^4$   
 e.  $x^5 \div x^2 = x^3$   
 f.  $\frac{y^7}{y^3} = y^4$   
 g.  $n^{10} \div n^4 = n^6$   
 h.  $z^6 \div z^3 = z^3$   
 i.  $x^5 \div x^{-2} = x^7$   
 j.  $\frac{w^5}{w^{-3}} = w^8$   
 k.  $p^5 \div p^{-2} = p^7$   
 l.  $x^3 \div x^{-3} = x^6$   
 m.  $(x^3)^2 = x^6$   
 n.  $(y^3)^{-2} = y^{-6}$   
 o.  $(z^{-1})^{-3} = z^3$   
 p.  $\left(\frac{1}{w^2}\right)^{-3} = (w^{-2})^{-3} = w^6$
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2. a.  $(ab)^4 = a^4b^4$   
 b.  $(xy)^3 = x^3y^3$   
 c.  $\frac{3}{(3a)^2} = \frac{3}{9a^2} = \frac{1}{3a^2}$   
 d.  $(2a)^3 = 8a^3$   
 e.  $(3y)^4 = 81y^4$   
 f.  $(mn^2)^5 = m^5n^{10}$
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3. a.  $2a^2 \times a^3 = 2a^5$   
 b.  $x^2 \times 3x^4 = 3x^6$   
 c.  $2y^2 \times 3y^2 = 6y^4$   
 d.  $8x^2 \div 2x = 4x$   
 e.  $10y^3 \div 2y^2 = 5y$   
 f.  $6z^4 \div 3z^2 = 2z^2$   
 g.  $10y^2 \div 5y^3 = 2y^{-1} = 2 \cdot \frac{1}{y} = \frac{2}{y}$   
 h.  $12x^4 \div 3x^{-2} = 4x^6$

4. a.  $x^3(x^2 + x^4) = x^5 + x^7$   
 b.  $y^2(y^3 - y) = y^5 - y$   
 c.  $z^2(z^4 - 1) = z^6 - z^2$
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5. a.  $\frac{x^3 \times x^4}{x^2} = \frac{x^7}{x^2} = x^5$   
 b.  $\frac{t^3 \times t^6}{t^4} = \frac{t^9}{t^4} = t^5$   
 c.  $\frac{w^2 \times w^{-3}}{w^{-4}} = \frac{w^{-1}}{w^{-4}} = w^{(-1-(-4))} = w^3$
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6. a.  $2^n = 8 \quad n = 3$   
 b.  $3^n = 81 \quad n = 4$   
 c.  $4^n = 4 \quad n = 1$   
 d.  $3^n = \frac{1}{3} \quad 3^n = 3^{-1} \therefore n = -1$
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7. a.  $3x^{-1} = 3 \cdot \frac{1}{x} \rightarrow \frac{3}{x}$   
 b.  $5y^{-3} = 5 \cdot \frac{1}{y^3} \rightarrow \frac{5}{y^3}$   
 c.  $\frac{1}{2}x^{-1} = \frac{1}{2} \cdot \frac{1}{x} \rightarrow \frac{1}{2x}$   
 d.  $\frac{3}{4}u^{-3} = \frac{3}{4} \cdot \frac{1}{u^3} \rightarrow \frac{3}{4u^3}$
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8. a.  $m^{\frac{3}{4}} = (\sqrt[4]{m})^3 \text{ or } \sqrt[4]{m^3}$   
 b.  $x^{\frac{4}{5}} = (\sqrt[5]{x})^4 \text{ or } \sqrt[5]{x^4}$   
 c.  $k^{\frac{2}{3}} = (\sqrt[3]{k})^2 \text{ or } \sqrt[3]{k^2}$   
 d.  $x^{\frac{1}{2}} = \sqrt{x}$   
 e.  $x^{-\frac{1}{2}} = \frac{1}{x^{\frac{1}{2}}} = \frac{1}{\sqrt{x}}$   
 f.  $x^{\frac{2}{3}} = \frac{1}{x^{\frac{1}{3}}} = \frac{1}{(\sqrt[3]{x})^2} \text{ or } \frac{1}{\sqrt[3]{x^2}}$
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**Solutions to Indices** (continued)

9. a.  $\sqrt[3]{y^5} = y^{\frac{5}{3}}$

b.  $\sqrt[3]{z^4} = z^{\frac{4}{3}}$

c.  $\sqrt{x} = x^{\frac{1}{2}}$

d.  $\sqrt[3]{t} = t^{\frac{1}{3}}$

10. a.  $9^{\frac{1}{2}} = \sqrt{9} = 3$

b.  $8^{\frac{1}{3}} = \sqrt[3]{8} = 2$

c.  $27^{\frac{1}{3}} = \sqrt[3]{27} = 3$

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

e.  $27^{\frac{2}{3}} = (\sqrt[3]{27})^2 = 3^2 = 9$

f.  $4^{\frac{3}{2}} = (\sqrt{4})^3 = 2^3 = 8$

g.  $25^{\frac{3}{2}} = (\sqrt{25})^3 = 5^3 = 125$

h.  $81^{\frac{3}{4}} = (\sqrt[4]{81})^3 = 3^3 = 27$

11. a.  $u^{\frac{3}{2}} \times u^{\frac{1}{2}} = u^{\frac{3}{2} + \frac{1}{2}} = u^2 = u^2$

b.  $v^{\frac{4}{3}} \times v^{\frac{1}{3}} = v^{\frac{4}{3} + \frac{1}{3}} = v^{\frac{5}{3}} = v^{\frac{5}{3}}$

c.  $x^{\frac{3}{2}} \div x^{\frac{1}{2}} = x^{\frac{3}{2} - \frac{1}{2}} = x^1 = x$

d.  $y^{\frac{3}{4}} \div y^{\frac{1}{4}} = y^{\frac{3}{4} - \frac{1}{4}} = y^{\frac{2}{4}} = y^{\frac{1}{2}} = \sqrt{y}$

e.  $\left(t^{\frac{1}{2}}\right)^2 = t^{2 \times \frac{1}{2}} = t^1 = t$

f.  $\left(p^{-\frac{1}{2}}\right)^2 = p^{-\frac{1}{2} \times 2} = p^{-1} = \frac{1}{p}$

g.  $\left(q^{\frac{1}{4}}\right)^0 = q^{\frac{1}{4} \times 0} = q^0 = 1$

h.  $\left(r^3\right)^{\frac{1}{3}} = r^{3 \times \frac{1}{3}} = r^1 = r$

12a.  $x^{\frac{1}{2}} \left(x^{\frac{1}{2}} + x^{-\frac{1}{2}}\right)$   
 $= x^{\frac{1}{2}} \cdot x^{\frac{1}{2}} + x^{\frac{1}{2}} \cdot x^{-\frac{1}{2}} = x^1 + x^0 = x + 1$

12b.  $m^{-\frac{3}{4}} \left(m^{\frac{7}{4}} - m^{-\frac{1}{4}}\right)$   
 $= m^{-\frac{3}{4}} \cdot m^{\frac{7}{4}} - m^{-\frac{3}{4}} \cdot m^{-\frac{1}{4}} = m^{\frac{4}{4}} - m^{\frac{4}{4}}$   
 $= m^1 - m^{-1} = m - \frac{1}{m}$

12c.  $\frac{a^3 \times a^{-2}}{a} = \frac{a^1}{a} = \frac{a}{a} = 1$

12d.  $\frac{c^2 \times c^{-2}}{c^{-1}} = \frac{c^0}{c^{-1}} = c^{0 - (-1)} = c^1 = c$

12e.  $\frac{x^{\frac{1}{2}} \times x^{-\frac{3}{2}}}{x^2} = \frac{x^{-1}}{x^2} = x^{-1-2} = x^{-3} = \frac{1}{x^3}$

12f.  $\frac{y^{-\frac{1}{3}} \times y^{\frac{4}{3}}}{y} = \frac{y^1}{y} = \frac{y^1}{y} = \frac{y}{y} = 1$

12g.  $(a^2 + 1)(a^{-2} + 1)$  (Use FOIL)  
 $= a^2 \cdot a^{-2} + a^2 + a^{-2} + 1 = a^0 + a^2 + \frac{1}{a^2} + 1$   
 $= 1 + a^2 + \frac{1}{a^2} + 1 = 2 + a^2 + \frac{1}{a^2}$

12h.  $(b^{-1} + 1)(b^{-1} - 1)$  (Use FOIL)  
 $= b^{-1} \cdot b^{-1} - b^{-1} + b^{-1} - 1 = b^{-2} - 1 = \frac{1}{b^2} - 1$

12i.  $\left(x^{\frac{1}{2}} + 1\right)\left(x^{\frac{1}{2}} + 1\right)$  (Use FOIL)  
 $= x^{\frac{1}{2}} \cdot x^{\frac{1}{2}} + x^{\frac{1}{2}} + x^{\frac{1}{2}} + 1 = x + 2\sqrt{x} + 1$

12j.  $\left(u^{\frac{1}{2}} + 1\right)\left(u^{\frac{1}{2}} + 1\right)$  (Use FOIL)  
 $= u^{\frac{1}{2}} \cdot u^{\frac{1}{2}} + u^{\frac{1}{2}} + u^{\frac{1}{2}} + 1 = u^0 + \sqrt{u} + 1 = 2 + \sqrt{u}$