

## Indices Revision Worksheet

Q1 Simplify the following

(a)  $2^{10n} \times 7^{4n} \div 2^{2n}$

(b)  $12^{3n+2} \times 6^{n-1} \times 8^{3n}$

(c)  $15^{2n+1} \times 5^3 \times 3^{n+4} \div 75^{n+2}$

(d)  $3^{3n+1} \times 9 \div 3^{n+1}$

(e)  $20^{n+2} \times 15^{2n+1} \div 6^{2n}$

Q2 Solve the following equations involving indices

(a)  $5^{2x-3} = \frac{1}{25}$

(b)  $6^x \times 36^{2x-5} = 1$

(c)  $9^{2x-5} = 1$

(d)  $2^x \times 4^{x+2} \times 8^{x-1} = 64$

(e)  $5^x \div 25^{x-1} = 125$

Q3 Given that  $3^x = 5$  and  $3^y = 7$ , find the value of  $3^{4x-2y}$ .

Q4 Evaluate the following

(a)  $\left(\frac{3}{4}\right)^0 \times \left(\frac{2}{5}\right)^{-3}$ ,

(b)  $\left(\frac{-3}{5}\right)^{-3}$

(c)  $\left(\frac{4}{9}\right)^{-2} \times \left(\frac{27}{8}\right)^{-3}$

\* (d)  $\frac{7^{x+1} - 7^{x-2}}{7^{x-1} - 7^{x+2}}$ .

Q5 Simplify  $7^{2x+1} - 4(7^{2x})$ .

Hence, or otherwise, solve the equation  $7^{2x+1} - 4(7^{2x}) = 1029$ .

Q6 A new dry cleaning machine has been designed. Following completion of each cleaning cycle, the dry cleaning liquid will be purified by evaporation and condensation. This will lead to a loss of two per cent of the dry cleaning liquid each time the machine is used.

- When the new machine is filled with 1000 ml of dry cleaning liquid. How much liquid will remain after the machine has been used once? How much liquid will remain after 2, 3, 4 and 5 uses? Think of a best approach to present all of your answers.
- Deduce a formula which uses indices to determine the amount of liquid left after  $n$  uses. Show that after 20 uses the quantity of liquid remaining is approximately two-thirds of the original quantity.
- How much liquid will remain after 40 uses? Express the answer as an approximate fraction of the original quantity?
- When the quantity of liquid is reduced to  $\frac{1}{4}$  of the original amount it is time to replace the liquid. After how many uses will the liquid need to be replaced? Show clearly how you arrive at this answer.
- The designers of the existing dry cleaning machines claim that the dry cleaning liquid of the new machine will last no more than 100 uses. Is this claim correct? Explain your reasons.