Week One – Indices and Surds

Warm-Up

Section A

Evaluate each of these without using a calculator.

a $49^{\frac{1}{2}}$ **b** $27^{\frac{1}{3}}$ **c** 5^{-1} **d** $64^{-\frac{1}{3}}$

e $9^{\frac{3}{2}}$ **f** $16^{\frac{3}{4}}$ **g** $125^{-\frac{2}{3}}$ **h** $\left(\frac{1}{2}\right)^{3}$

i $\left(\frac{1}{9}\right)^{-2}$ **j** $\left(\frac{4}{9}\right)^{\frac{1}{2}}$ **k** $\left(\frac{9}{16}\right)^{-0.5}$ **l** $\left(\frac{27}{8}\right)^{-\frac{2}{3}}$

Section B

Simplify these expressions fully without using a calculator.

a $\frac{1}{\sqrt{7}}$ **b** $\frac{2}{\sqrt{8}}$ **c** $\frac{12}{\sqrt{3}}$ **d** $\frac{\sqrt{8}}{\sqrt{12}}$

e $\frac{1}{1+\sqrt{3}}$ **f** $\frac{2}{1+\sqrt{2}}$ **g** $\frac{8}{1-\sqrt{5}}$ **h** $\frac{2}{\sqrt{5}-1}$

i $\frac{\sqrt{2}}{2+\sqrt{3}}$ **j** $\frac{2\sqrt{3}}{\sqrt{6}-2}$ **k** $\frac{1+\sqrt{2}}{1-\sqrt{2}}$ **l** $\frac{3+\sqrt{5}}{\sqrt{5}-3}$

Section C

Expand the brackets and fully simplify each expression.

a $(1+\sqrt{2})(3+\sqrt{2})$ **b** $(1+\sqrt{2})(3-\sqrt{2})$ **c** $(1-\sqrt{2})(3+\sqrt{2})$ **d** $(1-\sqrt{2})(3-\sqrt{2})$

e $(\sqrt{3}+2)(4+\sqrt{3})$ **f** $(\sqrt{3}+2)(4-\sqrt{3})$ **g** $(\sqrt{3}-2)(4+\sqrt{3})$ **h** $(\sqrt{3}-2)(4-\sqrt{3})$

Manipulating Indices

Example 1 Video Link

Write these expressions in simplified index form.

a $\sqrt[3]{x}$

$$\sqrt[3]{x}$$

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

Example 2 Video Link

Write these expressions in simplified index form.

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

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

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

Example 3 Video Link

Write these expressions in simplified index form.

c $\frac{2x}{\sqrt{x}}$

$$\frac{2x}{\sqrt{x}}$$

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

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

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

Exercise 1

Write each of these expressions in simplified index form.

a $x^3 \times x^7$ **b** $7x^5 \times 3x^6$ **c** $5x^4 \times 8x^7$ **d** $x^8 \div x^2$

e $8x^7 \div 2x^9$ **f** $3x^8 \div 12x^7$ **g** $(x^5)^7$ **h** $(x^2)^{-5}$

i $(3x^2)^4$ **j** $(6x^5)^2$ **k** $\sqrt{x^3}$ **l** $\sqrt[4]{x^5}$

m $\dfrac{5\sqrt{x}}{x}$ **n** $2x\sqrt{x}$ **o** $\dfrac{x^2}{3\sqrt{x}}$ **p** $x^3(x^5-1)$

q $x^3(\sqrt{x}+2)$ **r** $\dfrac{x+2}{x^3}$ **s** $\dfrac{\sqrt{x}+3}{x}$ **t** $\dfrac{(3-x^3)}{\sqrt{x}}$

u $(\sqrt{x}+3)^2$ **v** $\dfrac{3+\sqrt{x}}{x^2}$ **w** $\dfrac{1-x}{2\sqrt{x}}$ **x** $\dfrac{\sqrt{x}+2}{3x^3}$