Worksheet 1: Exponents and Surds

Grade 11 Mathematics

1. State the exponent rules. (K)

2. State the rules for surds. (K)

3. Simplify the following expressions (write answers with positive exponents):

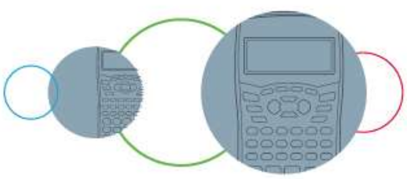
a)	$(ab^2c^3)^0$	b)	$\left(\frac{1}{xy^3}\right)^2$	(K)
c)	$(x^2yz^{-1})^3 \times (x^4yz^3)^{-1}$	d)	$\left(\frac{1}{xy^2}\right)^{-2} \times \left(\frac{x^3}{y^2}\right)^{-1}$	(R)
e)	$\frac{a^2b^{-2}c^3}{ab^{-1}c^2} \times \frac{(a^2b^{-2}c)^{-1}}{a^{-1}b^2c^3} \div \frac{ab}{c^4}$	f)	$\frac{fg}{h^3} \times \left(\frac{h^4}{f^2g}\right)^{-2} \div \frac{a^0f^2g^{-2}}{h^{-3}}$	(C)
g)	$\left(\frac{1}{x}+\frac{x}{y}\right)^{-2}$	h)	$\frac{27^{x+1}.18^{x-1}}{36^{3-x}}$	(C)
i)	$\frac{8^{2x+1}+4^{3x-1}}{2^{3x}}$	j)	$\frac{54^{x+1}.36^{x-1}}{24^{2x-3}}$	(C)

4. Solve for x in the following equations (to two decimal places where necessary):

a)	$5^{3x} - 5^{3x-1} = 4$	b)	$\frac{4^{x+2}+4^{x-1}}{5} = \frac{13}{16}$	(C)
c)	$2^{x-1} + 2^{2+x} = 144$	d)	$3^{x+1}.5 - 4.3^{x+2} = -\frac{7}{3}$	(C)
e)	$2^x - 5.2^{x+1} = -144$	f)	$5^{x+2} + 5^x = 26$	(R)
g)	$5.3^{x-2} - 5.3^{x+1} = -\frac{130}{729}$	h)	$5^{2x+4} - 25^{x-1} = 78\ 120$	(C)
i)	$3^{2-x} - 3^{-x-3} = \frac{242}{9}$	j)	$4^{x+1}.3 + 5.2^{2x-1} - 7 = \frac{1}{4}$	(P)
k)	$5^x = 200$	l)	$3^x.4 + 5 = 25$	(R)

5. Determine the values of (without the use of a calculator):

a)	$4^{\frac{3}{2}}$	b)	$64^{\frac{2}{3}}$	(R)
c)	$27^{\frac{2}{9}}$	d)	$49^{\frac{3}{4}}$	(R)
e)	$81^{\frac{5}{4}}$	f)	$48^{-\frac{1}{2}}$	(R)
g)	$100^{-\frac{3}{2}}$	h)	$32^{-\frac{2}{5}}$	(R)
i)	$36^{-\frac{5}{2}}$	j)	$24^{\frac{1}{3}}$	(R)



6. Say whether the following are surds or not:

a) $\sqrt{53}$ b) $\sqrt[3]{81}$ (R)

c) $\sqrt{56}$ d) $\sqrt{81}$ (R)

e) $\sqrt{9}$ f) $\sqrt[3]{9}$ (R)

g) $\sqrt{2}$ h) $\sqrt{121}$ (R)

i) $\sqrt[3]{121}$ j) $\sqrt{46}$ (R)

7. Simplify the following expressions:

a) $\frac{\sqrt{80}+\sqrt{45}}{\sqrt{125}}$ b) $\frac{\sqrt{8}-\sqrt{2}}{\sqrt{50}}$ (R)

c) $\frac{\sqrt{48}+\sqrt{147}}{\sqrt{242}}$ d) $\frac{\sqrt{2}(\sqrt{80}-\sqrt{45})}{\sqrt{1000}}$ (R)

e) $(5+\sqrt{2})(5-\sqrt{2})$ f) $(3\sqrt{2}-1)(3\sqrt{2}-2)$ (R/C)

g) $(3\sqrt{2}+2)^2$ h) $(\sqrt{7}-\sqrt{2})(\sqrt{7}+\sqrt{2})$ (C)

i) $(4-2\sqrt{5})(5-3\sqrt{5})$ j) $\left(\frac{2}{\sqrt{3}}+1\right)\left(\frac{\sqrt{3}}{2}-1\right)$ (P)

8. Solve for x in the following:

a) $\sqrt{x-3}=2$ b) $\sqrt[3]{4+x}=3$ (P)

c) $\sqrt{-x-1}=x+1$ d) $x=\sqrt{x+2}$ (P)

e) $\sqrt{3x^2}-\sqrt{12}=0$ f) $\sqrt{18}-x\sqrt{2}=\sqrt{32}$ (C)

g) $\sqrt{x+2}=9$ h) $(x-3)^{\frac{1}{2}}=4$ (C)

i) $\sqrt{6-2x}+3=x$ j) $x^2-5=\sqrt{x^2+1}$ (P)

9*. When we simplify surds, we often leave a square-root or cube-root in the denominator. However, the calculator *rationalizes* the answer so that there is no surd in the denominator, for example:

$\frac{1}{\sqrt{2}}=\frac{1}{\sqrt{2}}\times\frac{\sqrt{2}}{\sqrt{2}}=\frac{\sqrt{2}}{2}$ which is rationalised. Now rationalise the following:

a) $\frac{1}{\sqrt{3}}$ b) $\frac{2}{\sqrt{2}}$ (P)

c) $\frac{1+\sqrt{5}}{\sqrt{5}}$ d) $\frac{\sqrt{3}+2}{\sqrt{3}}$ (P)

e) $\frac{3}{1-\sqrt{2}}$ (P)

*This is a challenge question.