Useful formula I

Indices, Surds and Logarithms

Item	Laws of indices	Example	Practice
(i)	$a^m \times a^n = a^{m+n}$	$y^4 \cdot y^2 \cdot y^3 = y^9$	$b^5 \times b^4 \times b^7 =$
(ii)	$a^m \div a^n = a^{m-n}$	$x^{18} \div x^7 = x^{11}$	$\frac{y^5}{y^2} =$
(iii)	$(a^m)^n = a^{mn}$	$(x^2)^5 = x^{10}$	$(3x)^2 =$
(iv)	$(ab)^m = a^m b^m$	$(x^3 y^7)^4 = x^{12} y^{28}$	$(6xy)^4 =$
(v)	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$		
(vi)	$a^0 = 1$		
(vii)	$a^{-m} = \frac{1}{a^m}$	$x^{-2} = \frac{1}{x^2}$	$17^{-3} =$
(viii)	$a^{\frac{1}{m}} = \sqrt[m]{a}$	$144^{1/2} = \sqrt{144} = 12$	$125^{1/3} =$
(ix)	$a^{\frac{n}{m}} = \left(\sqrt[m]{a}\right)^n = \sqrt[m]{a^n}$	$32^{2/5} = \left(32^{1/5}\right)^2 = 4$	$8^{2/3} =$

Surds

Item	Surd	Example	Practice
(i)	$\sqrt{a} \times \sqrt{a} = a$	$\sqrt{3} \times \sqrt{3} = 3$	$\sqrt{16} \times \sqrt{16} =$
(ii)	$\left(\sqrt{a} + \sqrt{b}\right)\left(\sqrt{a} - \sqrt{b}\right) = a - b$	$\left(\sqrt{7} + \sqrt{5}\right)\left(\sqrt{7} - \sqrt{5}\right)$ $= 7 - 5 = 2$	$\left(\sqrt{11} + \sqrt{9}\right)\left(\sqrt{11} - \sqrt{9}\right)$ $=$

Logarithms

Item	Logarithms	Example	Practice
(i)	$\log_{10} 10 = 1$		
(ii)	$\log_{10} 1 = 0$		
(iii)	$\log_{10} pq = \log_{10} p + \log_{10} q$		
(iv)	$\log_{10} \frac{p}{q} = \log_{10} p - \log_{10} q$		
(v)	$\log_{10} p^n = n \log_{10} p$		

Expand

Item	Expand	Example	Practice
(i)	$(a+b)(c+d) = a(c+d) + b(c+d)$ $= ac + ad + bc + bd$	$(3+x)(2+y) = 3(2+y) + x(2+y)$ $= 6 + 3y + 2x + xy$	$(x+3)(y-2) =$

(ii)	$(x+m)(x+n)=x^2+mx+nx+mn$ $=x^2+(m+n)x+mn$	$(x+7)(x+3)=$ $x^2+10x+21$	$(x+5)(x-3)=$
(iii)	$(a+b)^2=a^2+2ab+b^2$	$(x+4)^2=x^2+8x+16$	$(x+7)^2=$
(iv)	$(a-b)^2=a^2-2ab+b^2$	$(x-5)^2=x^2-10x+25$	$(x-3)^2=$

Factorization I

Item	Expression	**Example**	**Practice**
(i)	$a^2-b^2=(a+b)(a-b)$	$x^2-y^2=(x+y)(x-y)$	$4x^2-25y^2=$
(ii)	$a^2+2ab+b^2=(a+b)^2$	$x^2+6x+9=(x+3)^2$	$x^2+12x+36=$
(iii)	$a^2-2ab+b^2=(a-b)^2$	$x^2-14x+49=(x-7)^2$	$x^2-8x+16=$
(iv)	$a^3+b^3=(a+b)(a^2-ab+b^2)$		
(v)	$a^3-b^3=(a-b)(a^2+ab+b^2)$		

Factorization II

General form of quadratic equation: $ax^2+bx+c=0$

Item	Quadratic equation **Example**	**Practice**
(i)	$ax^2+bx+c=0$	
(ii)	Factorize as $(px+q)(mx+n)=0$ The roots of the equation are $x=-\frac{q}{p}$ and $x=-\frac{n}{m}$	
(iii)	Quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$	

Nature of roots:

$ax^2+bx+c=0$ discriminant: $\Delta=b^2-4ac$

Item	Nature of roots	Description		Sum and product of roots	Forming quadratic equations
(i)	$\Delta>0$	Two unequal real roots		a and b be the roots of $ax^2+bx+c=0$	a and b are the roots of a quadratic equation

(ii)	$\Delta = 0$	One real root		Sum of roots = $a + b = -\frac{b}{a}$	The equation can be $x^2 - (a + b)x + ab = 0$
(iii)	$\Delta < 0$	No real root		Product of roots = $ab = \frac{c}{a}$	