C.E.M.TUITION

Name :__________________________________

HSC PROOFS

2/3 Unit

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2 Unit

Sequence and Series

[1] A sequence in arithmetic progression is in the form $a, a+d, a+2d, \ldots, a+(n-1)d$
Show that $S_n = \frac{n}{2}(a+l)$ where $l = a+(n-1)d$

[2] A sequence in geometric progression is given by $a, ar, ar^2, \ldots, ar^{n-1}$.

Show that $S_n = \dfrac{a(1-r^n)}{1-r}$

Differentiation from first principles

[1] $\dfrac{dy}{dx} = \lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$, find $f'(x)$ if

[a] $f(x) = \sqrt{x}$

[b] $f(x) = \dfrac{1}{x}$

Quadratic equation

If α and β are the roots of the quadratic equation $ax^2 + bx + c = 0$, show that

[a] $\alpha + \beta = -\frac{b}{a}$ [b] $\alpha\beta = \frac{c}{a}$

3 Unit : Cubic equation

Similarly, if α, β and γ are the roots of the cubic equation $ax^3 + bx^2 + cx + d = 0$
Show that :

[a] $\alpha + \beta + \gamma = -\frac{b}{a}$ [b] $\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$ [c] $\alpha\beta\gamma = -\frac{d}{a}$

Finance Maths

Compound interest : P : Principal, $r\%$: rate of interest per period, n : periods.
A_n : Amount at the end of n periods.

Show that $A_n = PR^n$ where $R = 1+\frac{r}{100}$

Superannuation :

Show that $\$P$ invested at the beginning of each period for n periods at $r\%$ per period is

$$A_n = \frac{PR(R^n - 1)}{R - 1}$$

Time payments or annuities :

Show that the amount owing at the end of n periods on a loan of \$$P$ over n periods at r% per period with a regular repayments (i.e instalments) of \$$M$ is given by :

$$A_n = PR^n - \frac{M(R^n - 1)}{R - 1}$$

Parabola :

Show that the locus of $P(x, y)$ whose distance from a fixed point $S(0, a)$ equal to its distance from a fixed line $y = -a$ is given by $x^2 = 4ay$.

3 Unit : Acceleration as a function of x

Show that $a = \frac{d}{dx}\left(\frac{1}{2}v^2\right)$

3 Unit : Inverse Trigonometric Ratios

Show that [1] if $y = \sin^{-1}x$ then $\dfrac{dy}{dx} = \dfrac{1}{\sqrt{1-x^2}}$

[2] If $y = \tan^{-1}x$, then $\dfrac{dy}{dx} = \dfrac{1}{1+x^2}$

3 Unit : Binomial theorem

Show that $\binom{n}{k}=\dfrac{n(n-1)(n-2)\dots(n-k+1)}{1\times 2\times 3\times\dots\times k}$ for $1\leq k\leq n$ by mathematical induction.