NO:................................ DATE:................................

$y = e^x$ $\quad \sin^2\theta + \cos^2\theta = 1$ $\quad \sin(A+B) = \sin A \cos B + \cos A \sin B$

$\frac{dy}{dx} = e^x$ $\quad \tan^2\theta + 1 = \sec^2\theta$ $\quad \cos(A+B) = \cos A \cos B - \sin A \sin B$

$\int \frac{1}{x} dx = \ln x + C$ $\quad \sin 2A = 2 \sin A \cos A$

$\int \frac{f'(x)}{f(x)} dx$ $\quad \frac{d}{dx}(\sin x) = \cos(x)$ $\quad \cos 2A = \cos^2 A - \sin^2 A$

$= \ln(f(x)) + C$ $\quad \frac{d}{dx}(\tan x) = \frac{1}{\cos^2(x)} = \sec^2(x)$ $\quad = 1 - 2\sin^2 A$

$\pi = 180°$

Area of sector : $\frac{1}{2}Sr = \frac{1}{2}\theta r^2$

- approximate CHANGE in $y \Rightarrow \delta y = \frac{dy}{dx} \times \delta x$
- approximate VALUE of $y \Rightarrow y_{new} = y_{old} + \delta y$
- approximate PERCENTAGE ERROR / CHANGE of y

$y = mx + C$ $\quad \frac{dy}{dx} \approx \frac{\delta y}{\delta x}$

$m = \frac{y - y_1}{x - x_1} = \frac{rise}{run}$ $\quad \delta y = \frac{dy}{dx} \times \delta x$ $\quad \Rightarrow \frac{\delta y}{y} = \frac{dy}{dx} \times \frac{\delta x}{y}$

$y - y_1 = m(x - x_1)$

$m_1 \times m_2 = -1$ $\quad$ tangent gradient $\times$ normal gradient $= -1$

$d = \sqrt{(x_1 - x_2)^2 + (y_1 + y_2)^2}$ $\quad$ CAS $\rightarrow$ menu $\rightarrow 4 \rightarrow 9 \rightarrow$ tangent line $(x^2+2, x, 2)$

$\searrow$ A $\rightarrow$ normal line $(x^2+2, x, 2)$

cost $[C(x)]$; revenue $[R(x)]$; profit $[P(x)]$

$P(x) = R(x) - C(x)$

marginal cost $[\frac{dC}{dx}]$ $\quad$ average cost $[\frac{C(x)}{x}]$

marginal revenue $[\frac{dR}{dx}]$ $\quad$ average revenue $[\frac{R(x)}{x}]$

marginal profit $[\frac{dP}{dx}]$ $\quad$ average profit $[\frac{P(x)}{x}]$

area under curve
$\Rightarrow$ if graph area falls below x-axis, add modulus '| |'

Displacement $\quad$ total change $= \int_a^b \underbrace{\frac{dv}{dt}}_{\text{rate of change}}$

$\int dt \uparrow \quad \downarrow \frac{d}{dt}$

Velocity

$\int dt \uparrow \quad \downarrow \frac{d}{dt}$

Acceleration

$\frac{d}{dx} \int_a^x f(t)\, dt = f(x)$

$\frac{d}{dx} \int_a^{g(x)} f(t)\, dt = f[g(x)] \times g'(x)$

$\int_5^2 f(x)\, dx = -\int_2^5 f(x)\, dx$

$\int_a^a f(x)\, dx = 0$

Special formulas:

i) $\int f'(x) e^{f(x)} dx = e^{f(x)} + C$

ii) $\int f'(x)[f(x)]^n dx = \frac{[f(x)]^{n+1}}{n+1} + C$

iii) $\int \frac{f'(x)}{f(x)} dx = \ln(f(x)) + C$

iv) $\int x^{-1} dx = \int \frac{1}{x} dx = \ln(x) + C$

Distance

$\int |v| dt \uparrow \quad) \frac{dx}{dt}$

speed

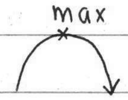
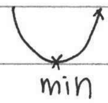
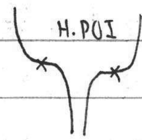
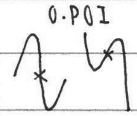
average change $= \frac{\text{total change}}{\text{time}}$

$\frac{f(b) - f(a)}{b - a}$

$t = 0$ when particle at rest $\quad$ constant acceleration

x changing direction $\quad = \uparrow$ velocity

$\int_a^b f'(x)\, dx = f(b) - f(a)$

type	shape	$f'(x)$	$f''(x)$	stationary point	turning point
maximum		$f'(x)=0$; $x=a$	$f''(x)<0$ ** $f''(x)\leq 0$ sub a	✓	✓
minimum		$f'(x)=0$; $x=b$	$f''(x)>0$ ** $f''(x)\geq 0$ sub b	✓	✓
Horizontal Point of Inflection		$f'(x)=0$; $x=c$	$f''(x)=0$ $f''(c)=0$	✓	×
Oblique Point of Inflection	 $f'(x)<0$ $f'(x)>0$	$f'(x)>0$ / $f'(x)<0$ BUT never $=0$	$f''(x)=0$ ↳ $x=e$	×	×

viii. $\frac{d}{dx}(\ln(f(x))) = \frac{f'(x)}{f(x)}$

Optimisation:

1. find variables × optimised function
2. relationship function
3. stationary points ($f'(x)=0$)
4. nature : $f''(x)>0 \Rightarrow$ min ; $f''(x)<0 \Rightarrow$ max
5. domain / range restricted ?
   find global max / min

Logarithms × Indices:

$a^n = x$; $\log_a(x) = n$

i. $\log_a(xy) = \log_a(x) + \log_a(y)$

ii. $\log_a\left(\frac{x}{y}\right) = \log_a(x) - \log_a(y)$

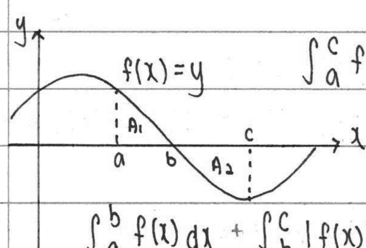
iii. $\log_a(x^y) = y\log_a(x)$

iv. $\log_x(y) = \frac{\log_a(y)}{\log_a(x)}$

v. $\log_x(1) = 0$; $\log_a(a) = 1$

vi. $\log_e(x) = \ln(x)$

vii. $\frac{d}{dx}(\log_a(x)) = \frac{1}{x\ln(a)}$

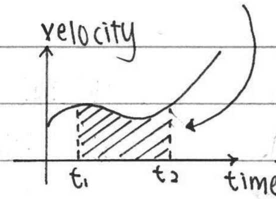


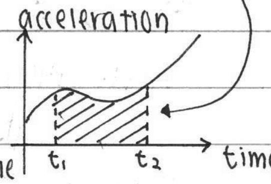
$\int_a^c f(x)\,dx = A_1 + (-A_2)$

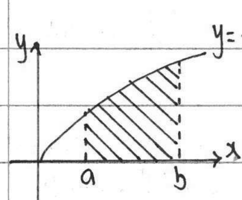
$= A_1 - A_2$

$\int_a^b f(x)\,dx + \int_b^c |f(x)|\,dx$

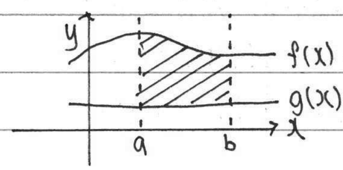
Area = displacement   Area = velocity



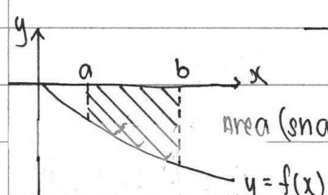




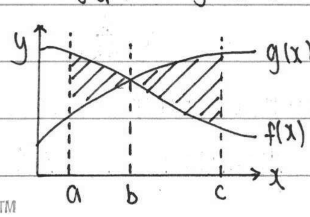
Area (shaded) $= \int_a^b f(x)\,dx$



Area (shaded) $= \int_a^b f(x) - g(x)\,dx$ "top - bottom"



Area (shaded) $= -\int_a^b f(x)\,dx$



Area (shaded) $= \int_a^b f(x) - g(x)\,dx + \int_b^c g(x) - f(x)\,dx$

NO:.................................   DATE:.................................