Q. No. 2 Part (i) (Page 1)

$$\lim_{\theta \to 0} \frac{1-\cos\theta}{\sin^2\theta}$$

$$= \lim_{\theta \to 0} \frac{1-\cos\theta}{1-\cos^2\theta}$$

$\therefore \sin^2\theta + \cos^2\theta = 1$

$\sin^2\theta = 1 - \cos^2\theta$

$$= \lim_{\theta \to 0} \frac{1-\cos\theta}{(1+\cos\theta)(1-\cos\theta)}$$

$$= \lim_{\theta \to 0} \frac{1}{1+\cos\theta}$$

$$= \frac{1}{1+\cos 0}$$

$$= \frac{1}{1+1}$$

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

$$\boxed{\lim_{\theta \to 0} \frac{1-\cos\theta}{\sin^2\theta} = \frac{1}{2}}$$

Q. No. 2 Part (I) (Page 2)

Q. No. 2 Part (ii) (Page 1)

CONTINUOUS AT $x=1$

$f(x)$	$\lim_{x\to 1} f(x)$
$f(x) = 2(K-1)x$	$f(x) = \frac{3x^2-3}{x-1}$
$f(1) = 2(K-1)1$	$\lim_{x\to 1} f(x) = \lim_{x\to 1} \frac{3x^2-3}{x-1}$
$= 2(K-1)$	$= \lim_{x\to 1} \frac{3(x^2-1)}{x-1}$
	$= \lim_{x\to 1} \frac{3(x+1)(x-1)}{x-1}$
	$= \lim_{x\to 1} 3(x+1)$
	$= 3 \lim_{x\to 1} (x+1)$
	$= 3\ [1+1]$
	$= 3(2)$
	$= 6$

if $f(x)$ is continuous at $x=1$

$$f(1) = \lim_{x\to 1} f(x)$$

$$2(K-1) = 6$$

$$K-1 = 3$$

$$K = 3+1$$

$$K = 4$$

(Section B)

Q. No. 2 Part (ii) (Page 2)

Q. No. 2 Part (iii) (Page 1)

$f(x) = x^3 - 5x + 1$

differentiate w.r.t x

$f'(x) = \frac{d}{dx}(x^3 - 5x + 1)$

$= 3x^2 - 5(1) + 0$

$= 3x^2 - 5$

$$x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$$

1st Iteration

$x_0 = 0.5$

$f(x_0) = f(0.5)$

$= (0.5)^3 - 5(0.5) + 1$

$= \frac{1}{8} - \frac{5}{2} + 1$

$= -\frac{11}{8}$

$f'(x_0) = 3(0.5)^2 - 5$

$= 3\left(\frac{1}{4}\right) - 5$

$= -\frac{17}{4}$

$x_{0+1} = x_0 - \frac{f(x_0)}{f'(x_0)}$

$= 0.5 - \frac{(-11/8)}{(-17/4)}$

$= \frac{3}{17}$

$x_1 = 0.1765$

2nd Iteration

$x_1 = 0.1765$

$f(x_1) = f(0.1765)$

$= (0.1765)^3 - 5(0.1765) + 1$

$= 0.122998$

$f'(x_1) = f'(0.1765)$

$= 3(0.1765)^2 - 5$

$= -4.906543$

$x_{1+1} = x_1 - \frac{f(x_1)}{f'(x_1)}$

$x_2 = 0.1765 - \frac{0.122998}{-4.906543}$

$= 0.2015$

$$x_1 = 0.1765, \quad x_2 = 0.2015$$

Q. No. 2 Part (iii) (Page 2)

Q. No. 2 Part (iv) (Page 1)

PART(a)

$\vec{r}(t) = t^3 \underline{i} + e^{-2t} \underline{j} + \sin 2t\, \underline{k}$

differentiate w.r.t t

$$\frac{d\vec{r}}{dt} = \frac{d}{dt} t^3 \underline{i} + \frac{d}{dt} e^{-2t} \underline{j} + \frac{d}{dt} \sin 2t\, \underline{k}$$

$$\vec{v}(t) = 3t^2 \underline{i} + e^{-2t} \frac{d}{dt}(-2t)\, \underline{j} + \cos 2t \frac{d}{dt}(2t)\, \underline{k}$$

$$= 3t^2 \underline{i} + e^{-2t} [-2]\, \underline{j} + \cos 2t\, (2)\, \underline{k}$$

$$= 3t^2 \underline{i} - 2e^{-2t} \underline{j} + 2\cos 2t\, \underline{k}$$

$$\vec{v}(t) = 3t^2 \underline{i} - 2e^{-2t} \underline{j} + 2\cos 2t\, \underline{k}$$

PART (b)

Acceleration vector

$$\vec{a}(t) = \frac{d\vec{v}}{dt}$$

$$= \frac{d}{dt}\left[3t^2 \underline{i} - 2e^{-2t} \underline{j} + 2\cos 2t\, \underline{k}\right]$$

$$= 3\frac{d}{dt}[t^2]\, \underline{i} - 2\frac{d}{dt}[e^{-2t}]\, \underline{j} + 2\frac{d}{dt} \cos 2t\, \underline{k}$$

$$= 3(2t)\, \underline{i} - 2e^{-2t}(-2)\, \underline{j} + 2(-\sin 2t)\frac{d}{dt}(2t)\, \underline{k}$$

$$= 6t\, \underline{i} + 4e^{-2t} \underline{j} - 2\sin 2t\, (2)\, \underline{k}$$

$$\vec{a}(t) = 6t\underline{i} + 4e^{-2t} \underline{j} - 4\sin 2t\, \underline{k}$$

Q. No. 2 Part (iv) (Page 2)

Q. No. 2 Part (ix) (Page 1)

First Principle Method

$$y = (2x+3)^{3/2}$$

$$y + \delta y = \left[2(x+\delta x)+3\right]^{3/2}$$

$$= \left[2x+2\delta x+3\right]^{3/2}$$

$$\delta y = \left[2x+2\delta x+3\right]^{3/2} - y$$

$$= \left[2x+2\delta x+3\right]^{3/2} - (2x+3)^{3/2}$$

$$= \left[2x+3+2\delta x\right]^{3/2} - (2x+3)^{3/2}$$

$$= (2x+3)^{3/2}\left[1+\frac{2\delta x}{2x+3}\right]^{3/2} - (2x+3)^{3/2}$$

$$= (2x+3)^{3/2}\left[\left(1+\frac{2\delta x}{2x+3}\right)^{3/2} - 1\right]$$

$$= (2x+3)^{3/2}\left[1+\frac{3}{2}\left(\frac{2\delta x}{2x+3}\right)+\frac{3/2(3/2-1)}{2!}\left(\frac{2\delta x}{2x+3}\right)^2+\frac{3/2(3/2-1)(3/2-2)8(\delta x)^3}{3!\,(2x+3)^3}+\ldots-1\right]$$

$$= (2x+3)^{3/2}\left[1+\frac{3}{2}\left(\frac{2\delta x}{2x+3}\right)+\frac{3}{8}\frac{(4)(\delta x)^2}{(2x+3)^2}-\frac{1}{16}\frac{(\delta x)^3}{(2x+3)^3}+\ldots-1\right]$$

$$= (2x+3)^{3/2}\left[\frac{3}{2}\left(\frac{2\delta x}{2x+3}\right)+\frac{3}{2}\frac{(\delta x)^2}{(2x+3)^2}-\frac{1}{16}\frac{(\delta x)^3}{(2x+3)^3}+\ldots\right]$$

$$= (2x+3)^{3/2}\,\delta x\left[\frac{3}{2}\left(\frac{2}{2x+3}\right)+\frac{3}{2}\frac{\delta x}{(2x+3)^2}-\frac{1}{16}\frac{(\delta x)^2}{(2x+3)^3}+\ldots\right]$$

$$\frac{\delta y}{\delta x} = \frac{(2x+3)^{3/2}\,\delta x}{\delta x}\left[\frac{3}{2}\left(\frac{2}{2x+3}\right)+\frac{3}{2}\frac{\delta x}{(2x+3)^2}-\frac{1}{16}\frac{(\delta x)^2}{(2x+3)^3}+\ldots\right]$$

$$= (2x+3)^{3/2}\left[\frac{3}{2}\left(\frac{2}{2x+3}\right)+\frac{3}{2}\frac{\delta x}{(2x+3)^2}-\frac{1}{16}\frac{(\delta x)^2}{(2x+3)^3}+\ldots\right]$$

$$\lim_{\delta x\to 0}\frac{\delta y}{\delta x} = (2x+3)^{3/2}\left[\frac{3}{2}\left(\frac{2}{2x+3}\right)+\frac{3}{2}\frac{(0)}{(2x+3)^2}-\frac{1}{16}\frac{(0)^2}{(2x+3)^3}+\ldots\right]$$

$$\frac{dy}{dx} = (2x+3)^{3/2}\left[\frac{3}{2}\left(\frac{2}{2x+3}\right)+0\right]$$

Q. No. 2 Part (ix) (Page 2)

$$= (2x+3)^{3/2}\left(\frac{3}{2}\right)\left(\frac{2}{2x+3}\right)$$

$$= 3(2x+3)^{3/2-1}$$

$$= 3(2x+3)^{1/2}$$

$$\frac{dy}{dx} = 3(2x+3)^{1/2}$$

Q. No. 2 Part (v) (Page 1)

$(3t+1)(t-1)$

$3t^2-3t+t-1$

$$\int (3t+1)(t-1)\,dt$$

$$= \int (3t^2-3t+t-1)\,dt$$

$$= \int (3t^2-2t-1)\,dt$$

$$= 3\int t^2\,dt - 2\int t\,dt - \int dt$$

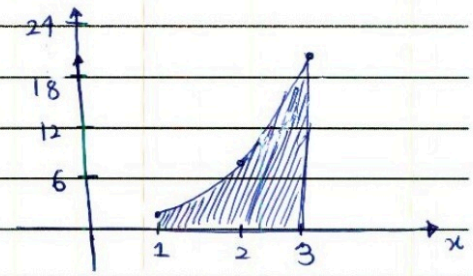
$$= 3\frac{t^3}{3} - 2\frac{t^2}{2} - t + c$$

$$= t^3 - t^2 - t + c$$

(Section B)

Q. No. 2 Part (v) (Page 2)

Q. No. 2 Part (vi) (Page 1)



$f(x) = 3x^2 - 2x$

Area under the graph

$= \int_1^3 f(x)\,dx$

$= \int_1^3 (3x^2 - 2x)\,dx$

$= 3\int_1^3 x^2\,dx - 2\int_1^3 x\,dx$

$= 3\frac{x^3}{3}\Big|_1^3 - 2\frac{x^2}{2}\Big|_1^3$

$= x^3\Big|_1^3 - x^2\Big|_1^3$

$= [3^3 - 1^3] - [3^2 - 1^2]$

$= [27 - 1] - [9 - 1]$

$= 26 - 8$

$= 18$

Area under the graph = 18

(Section B)

Q. No. 2 Part (vi) (Page 2)

Q. No. 2 Part (vii) (Page 1)

$3x^2 - 2xy - 8y^2$

(PART a)

$3x^2 - 2xy - 8y^2 = 0$

$3x^2 - 6xy + 4xy - 8y^2 = 0$

$3x(x - 2y) + 4y(x - 2y) = 0$

$(3x + 4y)(x - 2y) = 0$

Pair of straight lines:

$3x + 4y = 0$

$x - 2y = 0$

(PART b)

$$\left.\begin{aligned} 3x^2 - 2xy - 8y^2 &= 0 \\ ax^2 + 2hxy + by^2 &= 0 \end{aligned}\right\} \text{compare}$$

$a = 3 \quad 2h = -2 \quad b = -8$

$h = -1$

$\tan\theta = \dfrac{2\sqrt{h^2 - ab}}{a + b}$

$= \dfrac{2\sqrt{(-1)^2 - 3(-8)}}{3 - 8}$

$= \dfrac{10}{-5}$

$= -2$

$\theta = \tan^{-1}(-2)$

$\theta = -63.4349 + 180$

$= 116.565°$

Q. No. 2 Part (vii) (Page 2)

Q. No. 2 Part (viii) (Page 1)

A (5, 4) , B (2, 1) , C (7, 3)

Area of triangle

$$= \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$$

$$= \frac{1}{2}\begin{vmatrix} 5 & 4 & 1 \\ 2 & 1 & 1 \\ 7 & 3 & 1 \end{vmatrix}$$

$$= \frac{1}{2}\left\{5(1-3) - 4(2-7) + 1(6-7)\right\}$$

$$= \frac{1}{2}\left\{5(-2) - 4(-5) + 1(-1)\right\}$$

$$= \frac{1}{2}\left\{-10 + 20 - 1\right\}$$

$$= \frac{1}{2}(9)$$

$$= \frac{9}{2}$$

$$= 4.5$$

(Section B)

Q. No. 2 Part (viii) (Page 2)

Q. No. 2 Part (x) (Page 1)

$$\int \frac{e^x}{e^{2x}+1}\, dx$$

Let $u = e^x$

$du = e^x\, dx$

$$\int \frac{e^x}{e^{2x}+1}\, dx$$

$$= \int \frac{1}{u^2+1}\, du$$

$$= \tan^{-1} u + c$$

put $u = e^x$

$$= \tan^{-1} e^x + c$$

$$\int \frac{e^x}{e^{2x}+1}\, dx = \tan^{-1} e^x + c$$

Q. No. 2 Part (x) (Page 2)

Q. No. 2 Part (xi) (Page 1)

PARTIAL DIFFERENTIATION

PART a

$f(x,y) = \sqrt{x^3+y^3}$

$\frac{\partial f}{\partial x} = \frac{\partial}{\partial x}\sqrt{x^3+y^3}$

$= \frac{\partial}{\partial x}(x^3+y^3)^{1/2}$

$= \frac{1}{2}(x^3+y^3)^{1/2-1}\frac{\partial}{\partial x}(x^3+y^3)$

$= \frac{1}{2}(x^3+y^3)^{-1/2}[3x^2+0]$

$= \frac{3x^2}{2}(x^3+y^3)^{-1/2}$

$= \frac{3}{2}x^2(x^3+y^3)^{-1/2}$

$\frac{\partial f}{\partial x} = \frac{3x^2}{2\sqrt{x^3+y^3}}$

PART b

$f(x,y) = \sqrt{x^3+y^3}$

$\frac{\partial f}{\partial y} = \frac{\partial}{\partial y}(x^3+y^3)^{1/2}$

$= \frac{1}{2}(x^3+y^3)^{1/2-1}\frac{\partial}{\partial y}[x^3+y^3]$

$= \frac{1}{2}(x^3+y^3)^{-1/2}\left[\frac{\partial x^3}{\partial y}+\frac{\partial y^3}{\partial y}\right]$

$= \frac{1}{2}(x^3+y^3)^{-1/2}[0+3y^2]$

Q. No. 2 Part (xi) (Page 2)

$$= \frac{3y^2}{2}(x^3+y^3)^{-1/2}$$

$$\frac{\partial f}{\partial y} = \frac{3\ y^2}{2(x^3+y^3)^{1/2}}$$

Q. No. 2 Part (xii) (Page 1)

differentiation

$x^3 + 3x^2y^2 + y^3 = 0$

differentiate w.r.t x

$\frac{d}{dx}x^3 + 3\frac{d}{dx}(x^2y^2) + \frac{d}{dx}(y^3) = 0$

$3x^2 + 3\left[x^2\frac{d}{dx}y^2 + y^2\frac{d}{dx}x^2\right] + 3y^2\frac{dy}{dx} = 0$

$3x^2 + 3\left[x^2\, 2y\frac{dy}{dx} + y^2(2x)\right] + 3y^2\frac{dy}{dx} = 0$

$3x^2 + 6x^2y\frac{dy}{dx} + 6y^2x + 3y^2\frac{dy}{dx} = 0$

$6x^2y\frac{dy}{dx} + 3y^2\frac{dy}{dx} = -3x^2 - 6xy^2$

$(6x^2y + 3y^2)\frac{dy}{dx} = -3x^2 - 6xy^2$

$\frac{dy}{dx} = \frac{-3x^2 - 6xy^2}{6x^2y + 3y^2}$

$= \frac{3[-x^2 - 2xy^2]}{3[2x^2y + y^2]}$

$\frac{dy}{dx} = \frac{-x^2 - 2xy^2}{2x^2y + y^2}$

Q. No. 2 Part (xii) (Page 2)

Q. No. 3 (Page 1)

$$f(x) = \frac{1}{8}x^3 + \frac{1}{4}x^2 + \frac{2}{x^2} + \frac{1}{2}$$

$$y = \frac{1}{8}x^3 + \frac{1}{4}x^2 + \frac{2}{x^2} + \frac{1}{2}$$

$$\frac{dy}{dx} = \frac{1}{8}(3x^2) + \frac{1}{4}(2x) + 2(-2x^{-3}) + 0$$

$$= \frac{3}{8}x^2 + \frac{1}{2}x - \frac{4}{x^3}$$

Ordinate when $x=2$

$$y = \frac{1}{8}x^3 + \frac{1}{4}x^2 + \frac{2}{x^2} + \frac{1}{2}$$

$$= \frac{1}{8}(2)^3 + \frac{1}{4}(2)^2 + \frac{2}{(2)^2} + \frac{1}{2}$$

$$= \frac{1}{8}(8) + \frac{1}{4}(4) + \frac{2}{4} + \frac{1}{2}$$

$$= 3$$

Slope m

$$(x_1, y_1) = (2, 3)$$

$$m = \frac{dy}{dx}\Big/_{(2,3)}$$

$$= \frac{3}{8}x^2 + \frac{1}{2}x - \frac{4}{x^3}$$

$$= \frac{3}{8}(2)^2 + \frac{1}{2}(2) - \frac{4}{(2)^3}$$

$$= 2$$

PART 2

Equation of Tangent

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

$$m = 2 \quad (x_1, y_1) = (2, 3)$$

$$y - 3 = 2(x - 2)$$

$$y - 3 = 2x - 4$$

$$2x - y - 4 + 3 = 0$$

$$2x - y - 1 = 0$$

$$\boxed{2x - y - 1 = 0}$$

Q. No. 3 (Page 2)

PART B

Equation of normal

$m = 2 \qquad (x_1, y_1) = (2, 3)$

$y - y_1 = -\frac{1}{m}(x - x_1)$

$y - 3 = -\frac{1}{2}(x-2)$

$2(y-3) = -(x-2)$

$2y - 6 = -x + 2$

$x + 2y - 6 - 2 = 0$

$x + 2y - 8 = 0$

$\boxed{x + 2y - 8 = 0}$

PART C

CONTINUITY TEST

$x = 0$

(i) $f(x)$ is defined or not

For a function to be continuous at $x=0$, it must be defined at ~~a~~ $x=0$

$f(x) = \frac{1}{8}x^3 + \frac{1}{4}x^2 + \frac{2}{x^2} + \frac{1}{2}$

$f(0) = \frac{1}{8}(0)^3 + \frac{1}{4}(0)^2 + \frac{2}{(0)^2} + \frac{1}{2}$

$= \frac{2}{0} + \frac{1}{2}$

undefined

The function is not defined at $x=0$ so it is

discontinuous at $x=0$

Q. No. 3 (Page 3)

Q. No. 3 (Page 4)

Q. No. 4 (Page 1)

(PART a)

Median $\overline{CM}$

Midpoint of AB

$$M(x,y) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

$$= \left(\frac{1+7}{2}, \frac{2+2}{2}\right)$$

$$= (4, 2)$$

Equation of Median $\overline{CM}$

$M(4,2) \quad C(3,6)$

$$\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$$

$$\frac{y-2}{6-2} = \frac{x-4}{3-4}$$

$$\frac{y-2}{4} = \frac{x-4}{-1}$$

$$-1(y-2) = 4(x-4)$$

$$-y+2 = 4x-16$$

$$4x+y-16-2=0$$

$$4x+y-18=0$$

$$\boxed{4x+y-18=0}$$

Q. No. 4 (Page 2)

PART B
ALTITUDE $\overline{CD}$

Slope of $\overline{AB}$ A(1,2) B(7,2)

$m_1 = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{2-2}{7-1}$

$= 0$

Slope of $\overline{CD}$

Since altitude $\overline{CD}$ is perpendicular to $\overline{AB}$.

$m_2 = \frac{-1}{m_1}$

$= \frac{-1}{0}$

$= \infty$

Equation of altitude $\overline{CD}$

$\overline{CD}$ passes through C(3,6) and is perpendicular to horizontal.

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

$y - 6 = \frac{-1}{0}(x-3)$

$0(y-6) = -x+3$

$0 = -x+3$

$-x+3 = 0$

$x - 3 = 0$

$$\boxed{x-3=0}$$

Q. No. 4 (Page 3)

(PART C)

RIGHT BISECTOR of $\overline{AB}$

Slope of $\overline{AB}$

$$m_1 = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{2-2}{7-1}$$

$$= 0$$

Slope of bisector

Since right bisector is perpendicular to $\overline{AB}$

$$m_2 = \frac{-1}{m_1}$$

$$= \frac{-1}{0}$$

Midpoint of $\overline{AB}$

$$M(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$= \left(\frac{1+7}{2}, \frac{2+2}{2}\right)$$

$$= (4, 2)$$

RIGHT BISECTOR OF $\overline{AB}$

right bisector passes through $M(4,2)$ and is vertical

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

$$y - 2 = \frac{-1}{0}(x - 4)$$

$$(y-2)\,0 = x - 4$$

$$x - 4 = 0$$

$$\boxed{x - 4 = 0}$$

Q. No. 4 (Page 4)

Q. No. 5 (Page 1)

$$2xy\,dy - (x^2+3y^2)\,dx = 0$$

$$2xy\,dy = (x^2+3y^2)\,dx$$

$$\frac{dy}{dx} = \frac{(x^2+3y^2)}{2xy}$$

$$= \frac{x^2}{2xy} + \frac{3y^2}{2xy}$$

$$= \frac{x}{2y} + \frac{3y}{2x}$$

$$\frac{du}{dx} = \frac{1}{2}\left(\frac{x}{y}\right) + \frac{3}{2}\left(\frac{y}{x}\right) \quad \text{— (i)}$$

let $u = \frac{y}{x}$

$y = ux$

differentiate with respect to x

$$\frac{dy}{dx} = u + x\frac{du}{dx}$$

Substitute $u = \frac{y}{x}$ and $\frac{dy}{dx} = u + x\frac{du}{dx}$ in eq (i)

$$u + x\frac{du}{dx} = \frac{1}{2u} + \frac{3u}{2}$$

$$x\frac{du}{dx} = \frac{1}{2u} + \frac{3u}{2} - u$$

$$= \frac{1+3u^2-2u^2}{2u}$$

$$x\frac{du}{dx} = \frac{1+u^2}{2u}$$

$$\frac{2u}{1+u^2}\,du = \frac{1}{x}\,dx$$

Integrate both sides.

Q. No. 5 (Page 2)

$$\int \frac{2u}{1+u^2}\,du = \int \frac{1}{x}\,dx$$

$$\ln|1+u^2| = \ln x + \ln c$$

put $u = \frac{y}{x}$

$$\ln\left|1+\left(\frac{y}{x}\right)^2\right| = \ln x + \ln c$$

$$\ln\left|1+\frac{y^2}{x^2}\right| = \ln x + \ln c$$

$$\ln\left|1+\frac{y^2}{x^2}\right| = \ln xc$$

$$1+\frac{y^2}{x^2} = xc$$

Solving for y

$$\frac{y^2}{x^2} = xc - 1$$

$$y^2 = x^2(xc-1)$$

$$(y^2)^{1/2} = [x^2(xc-1)]^{1/2}$$

$$y = \pm x\sqrt{xc-1}$$

Q. No. 5 (Page 3)

Q. No. 5 (Page 4)

Q. No. 6 (Page 1)

SIMPSON'S RULE

(PART a)

$$\int_0^2 (3x^2-2x)\,dx$$

$b=2$, $a=0$, $f(x)=3x^2-2x$, $n=2$

$$\Delta x = \frac{b-a}{2n} = \frac{2-0}{2(2)} = \frac{1}{2} = 0.5$$

$\boxed{\Delta x = 0.5}$

x	$x_0 = 0$	$x_1 = 0.5$	$x_2 = 1$	$x_3 = 1.5$	$x_4 = 2$
$f(x)$	0	-0.25	1	3.75	8

$$S_4 = \frac{\Delta x}{3}\left[f_0 + 4(f_1+f_3) + 2(x_2) + f_4\right]$$

$$= \frac{0.5}{3}\left[0 + 4(-0.25+3.75) + 2(1) + 8\right]$$

$$= \frac{0.5}{3}[24]$$

$$= 4$$

approximate value by Simpson's rule: 4

Q. No. 6 (Page 2)

PART b

$\int_0^2 (3x^2-2x)\,dx$

$= \int_0^2 3x^2\,dx - \int_0^2 2x\,dx$

$= 3\int_0^2 x^2\,dx - 2\int_0^2 x\,dx$

$= 3\frac{x^3}{3}\Big|_0^2 - 2\frac{x^2}{2}\Big|_0^2$

$= x^3\Big|_0^2 - x^2\Big|_0^2$

$= [2^3-0^3] - [2^2-0^2]$

$= 8-4$

$= 4$

PART C

Error = Difference of both values

= Actual value − Approximate value

$= 4 - 4$

$= 0$

no error

Q. No. 6 (Page 3)

Q. No. 6 (Page 4)

$$\frac{2-0}{2n} = \frac{2}{2(2)} = 0.5$$

$$2xy\,dy = (3y^2+x^2)\,dx$$

$$\frac{dy}{dx} = \frac{3y^2+x^2}{2xy}$$

$$= \frac{3y}{2x} + \frac{x}{2y}$$

$$= \frac{3}{2}\left(\frac{y}{x}\right) + \frac{1}{2}\left(\frac{x}{y}\right)$$

$$u = \frac{y}{x}$$

$$y = ux$$

$$\frac{dy}{dx} = u + x\frac{du}{dx}$$

$$u + x\frac{du}{dx} = \frac{3}{2}u + \frac{1}{2u}$$

$$x\frac{du}{dx} = \frac{3}{2}u + \frac{1}{2u} - u$$

$$x\frac{du}{dx} = \frac{3u^2+1-2u^2}{2u}$$

$$= \frac{1+u^2}{2u}$$

$$\int \frac{2u}{1+u^2}\,du = \int \frac{1}{x}\,dx$$

$$\ln|1+u^2| = \ln x + \ln c$$

$$1+u^2 = xc$$

$$1 + \frac{y^2}{x^2} = xc$$

$$\frac{y^2}{x^2} = xc - 1$$

$2xy\,dy - (x^2+3y^2)dx = 0$

$2xy\,dy = (x^2+3y^2)dx$

$\frac{dy}{dx} = \frac{x^2+3y^2}{2xy}$

$= \frac{x^2}{2xy} + \frac{3y^2}{2xy}$

$= \frac{x}{2y} + \frac{3y}{2x}$

$= \frac{1}{2}\left(\frac{x}{y}\right) + \frac{3}{2}\left(\frac{y}{x}\right)$

$u = \frac{y}{x}$

$y = ux$

$\frac{dy}{dx} = u + x\frac{du}{dx}$

$u + x\frac{du}{dx} = \frac{1}{2u} + \frac{3u}{2}$

$x\frac{du}{dx} = \frac{1}{2u} + \frac{3}{2}u - u$

$= \frac{1+3u^2-2u^2}{2u}$

$x\frac{du}{dx} = \frac{1+u^2}{2u}$

$\int \frac{2u}{1+u^2}\,du = \int \frac{1}{x}dx$

$\ln|1+u^2| = \ln x + \ln c$

$1+u$

$\frac{2}{3}(x^3+y^3)^{2/3}(3x^2)$

$2g = 4 \quad | \quad 2f = 4$

$g = 2 \quad\quad f = 2 \quad c = 0$

$\frac{1-\cos\theta}{1}$

$dy = 2x\frac{1}{2}(x^3+y^3)^{-1/2}(3x^2)$

$3x^2 + 3\left[x^2\,2y\frac{dy}{dx} + y^2(2x)\right] + 3y^2\frac{dy}{dx}$

$3x^2 + 6x^2y\frac{dy}{dx} + 6xy^2 + 3y^2\frac{dy}{dx} = 0$

$(6x^2y+3y^2)\frac{dy}{dx} = \frac{-3x^2-6}{6x^2y+3}$

$\frac{-x^2-2xy}{2x^2y+y}$

$\frac{3x^2-3}{x-1}$

$\frac{3(x^2-1)}{x-1}$

$3(x+1)(x-1)$

$3(x+1) = 2(k-1)$

$3(1+1)$

$6 = 2(k-1)$

$3 = k-1$

$\frac{1}{x}\frac{dy}{dx} = 2$

$\int dy = 2x\,dx$

$y = 2\frac{x^2}{2} + c$

$\frac{1}{2}(x^3+y^3)^{1/2}$

$\int \cot x\,dx$

$= \ln\sin x$

$3x^2 - 2$

$3(0)^2$

$3x^2 - 2x$

$2(0)^2 - 2(0)$

$\Delta x = \frac{b-a}{n}$

$= \frac{2-0}{4}$

$= 0.5$

$dr = 2t\underline{i} - 2(1)j$

$= 2t\underline{i} - 2j$

$2\int_0^2 x\,dx = 2\left[\frac{x^2}{2}\right]_0^2$

$= \frac{2}{2}\left[2^2 - 0^2\right] = 3k - 2$

$4 = 3k - 2$

$6 = 3k$

$x^3 - 5x + 1$

$3x^2 - 5$

$3t^2\underline{i} + e^{-2t}(-2t)\underline{j} + \cos 2t\,(2)$

$\Rightarrow 3t^2\underline{i} - 2e^{-2t}\underline{j} + 2\cos 2t$

$\Rightarrow 3(2t)\underline{i} - 2(e^{-2t})(-2)\underline{j} + 2(-\sin 2t)(2)$

$= 6t\underline{i} + 4e^{-2t}\underline{j} - 4\sin 2t$

$4 = 3k - 2$

$6 = 3k$

$\frac{1}{2}\begin{vmatrix} e^5 & 4 & 1 \\ 2 & 1 & 1 \\ e^{7,0} & 3 & 1 \end{vmatrix}$

$= \frac{1}{2}[5(1-3) - 4(6-7) + 1(6-7)]$

$f'(x) = 3x^2 - 2$

$= 3(0)^2 - 2$

$M(4, 2) \quad C(3, 6)$

$\frac{y-2}{6-2} = \frac{x-4}{3-4}$

$\frac{y-2}{4} = \frac{x-4}{-1}$

$-y + 2 = 4x - 16$

$4x - 16 + y - 2 = 0$

$4x + y - 18 = 0$

$\frac{1}{8}(3x^2) + \frac{1}{4}(2x) + 2(-2x^{-3})$

$= \frac{3}{8}x^2 + \frac{1}{2}x - \frac{4}{x^3}$

$m = 0$

$m_2 = \infty$

$y - 2 = \infty(x - 4)$

$m = 0$

$m_2 = \frac{-1}{0}$

$y - 6 = \frac{-1}{0}(x-3)$

$0 = x - 3$