CHAPTER 1

1. If $f(x) = x^2$ and $g(x) = x^2+1$

i) g(g(0))

$g(0)=0^2+1=1$

$g(1)=1^2+1=2$

ii) f(g(2))

$g(2)=2^2+1=5$

$f(5)=5^2=25$

2. $f(x)=2^x$

i) $f(x^2)f(1)$

$f(x^2) = 2^{x^2}$

$f(1)=2^1$

$f(x^2)f(1)=2^{x^2} \times 2^1$

$=2^{x^2+1}$

ii) $\frac{f(x+3)}{f(-x)}$

$f(x+3)=2^{x+3}$

$f(-x)=2^{-x}$

$\frac{f(x+3)}{f(-x)}=\frac{2^{x+3}}{2^{-x}}$

$= 2^{x+3\,--x}$

$= 2^{x+3\,+x}$

$= 2^{2x+3}$

iii) $f\left(\sqrt{x}\right) = 2^{\sqrt{x}}$

iv) $f(x^2+1)=2^{x^2+1}$

3. $f(x)=10^x$

$f(x)+f(2+x)=10^x + 10^{2+x}$

$= 10^x + 10^2.10^x$

$= 10^x(1 + 10^2)$

$= 101.10^x$

ii) f(x)f(2+x)

$=10^x.10^{2+x}$

$= 10^{x+2+x}$

$= 10^{2x+2}$

$= 10^{2(x+1)}$

$iii)\ \frac{f(x)}{f(2+x)}$

$= \frac{10^x}{10^{2+x}}$

$= 10^{x-2-x}$

$= 10^{-2}$

Iv $\mathrm{f(f(2 + x)}$

$\mathrm{f(2 + x) = 10^{2+x}}$

$\mathrm{f(10^{2+x}) = 10^{10^{2+x}}}$

v) $f(\sin^2 x).f(\cos^2 x)$

$= 10^{\sin^2 x} + 10^{\cos^2 x}$

$= 10^{\sin^2 x + \cos^2 x}$

$= 10$

vi)THE QUESTION IS FAULTY

4) $\log_a 216 = 3$

$216=a^3$

$a^3=216$

$a^3=6^3$

a=6

ii) $\log_a 625 = 4$

$625 = a^4$

$a^4 = 625$

$a^4 = 5^4$

$a = 5$

iii) $\log_a {}^1/_{4a} = -2$

$\frac{1}{4a} = a^{-2}$

$\frac{1}{4a} = \frac{1}{a^2}$

$a^2 = 4a$

$a^2 - 4a = 0$

$a(a-4) = 0$

$a = 0 \; or \; a = 4$

iv) $\log_{14} x = 1/4$

$x = 14^{1/4}$

$x = 1.93$

5) $4^x = 7$

Take In of both sides

$In\ 4^x = In\ 7$

$x\ In\ 4 = In\ 7$

$x = \frac{In\ 7}{In\ 4} = 1.404$

b) $3^x = 6^{x+3}$

$Take\ In\ of\ both\ sides$

$In\ 3^x = In\ 6^{x+3}$

$xIn\ 3 = (x+3)In\ 6$

$xIn\ 3 = xIn\ 6 + 3In\ 6$

$xIn\ 3 - xIn\ 6 = 3In\ 6$

$x(In\ 3 - In\ 6) = 3In\ 6$

$x = \frac{3In6}{In\ 3 - In6} = -7.755$

c) $5^{x+1} = 9$

$Take\ In\ of\ both\ sides$

$In5^{x+1} = In9$

$(x+1)In5 = In9$

$xIn5 + In5 = In\ 9$

$xIn5 = In\ 9 - In5$

$x = \frac{In\ 9 - In5}{In\ 5} = 0.3652$

d) $2^{x-1} = 5^{2x+1}$

$Take\ In\ of\ both\ sides$

$In2^{x-1} = In5^{2x+1}$

$(x-1)In2 = (2x+1)In5$

$xIn2 - In2 = 2xIn5 + In5$

$xIn - 2xIn5 = In2 + In5$

$x(In - 2In5) = In2 + In5$

$x = \frac{In\ 2 + In5}{In\ 2 - 2In5} = -0.912$

e) $8^{x+2} = 3^{2x-1}$

$Take\ In\ of\ both\ sides$

$In8^{x+2} = In3^{2x-1}$

$(x+2)In8 = (2x-1)In3$

$xIn8 + 2In8 = 2xIn3 - In3$

$xIn8 - 2xIn3 = -In3 - 2In8$

$x(In8 - 2In3) = -In3 - 2In8$

$$x = \frac{-In3 - 2In8}{In8 - 2In3} = 44.637$$

f) $7^x = 4^{2x-1}$

$Take\ In\ of\ both\ sides$

$In7^x = In4^{2x-1}$

$xIn7 = (2x-1)In4$

$xIn7 = 2xIn4 - In4$

$xIn7 - 2xIn4 = -In4$

$x(In7 - 2In4) = -In4$

$$x = \frac{-In4}{In\ 7 - 2In4} = 1.677$$

X	Floor	ceiling
5.23	5	6
0.2	0	1
-7.1	-8	-7
3	3	3
-0.4	-1	0
1.9	1	2

CHAPTER 2

1.) $x + 7 = 0$

$x = -7$

Point of discontinuity occurs when x is -7

b) $x - 1 = 0$

$x = 1$

Point of discontinuity occurs when x is 1

c) $9 + x = 0$

$x = -9$

Point of discontinuity occurs when x is -9

2.a) $\lim_{x \to 2}(x^3 + 2x - 6)$

$=(2)^3+2(2)-6$

=8+4-6=6

$$b.\ \lim_{x\to\infty} \frac{4x^3 - x^2 + x - 2}{x^3 + 3x^2 - 3x + 1}$$

$$\lim_{x\to\infty} \frac{\frac{4x^3}{x^3} - \frac{x^2}{x^3} + \frac{x}{x^3} - \frac{2}{x^3}}{\frac{x^3}{x^3} + \frac{3x^2}{x^3} - \frac{3x}{x^3} + \frac{1}{x^3}}$$

$$\lim_{x\to\infty} \frac{4 - \frac{1}{x} + \frac{1}{x^2} - \frac{2}{x^3}}{1 + \frac{3}{x} - \frac{3}{x^2} + \frac{1}{x^3}}$$

$$\Rightarrow \frac{4 - \frac{1}{\infty} + \frac{1}{\infty^2} - \frac{2}{\infty^3}}{1 + \frac{3}{\infty} - \frac{3}{\infty^2} + \frac{1}{\infty^3}}$$

$$\Rightarrow\ 4$$

3. Yes

4i) f(x) is continuous for all values of x except at x = -3

ii) f(x) is continuous for all values of x

5. $f(x) = \frac{x-1}{x^2+x-2}$

i) $\lim_{x\to 0} f(x) = \lim_{x\to 0} \frac{x-1}{x^2+x-2}$

$\Rightarrow \frac{0-1}{0^2+0-2} = 1/2$

ii) i) $\lim_{x\to\infty} f(x) = \lim_{x\to\infty} \frac{x-1}{x^2+x-2}$

$= \lim_{x\to\infty} \frac{\frac{x}{x^2}-\frac{1}{x^2}}{\frac{x^2}{x^2}+\frac{x}{x^2}-\frac{2}{x^2}}$

$= \lim_{x\to\infty} \frac{\frac{1}{x}-\frac{1}{x^2}}{1+\frac{1}{x}-\frac{2}{x^2}}$

$\Rightarrow \frac{\frac{1}{\infty}-\frac{1}{\infty^2}}{1+\frac{1}{\infty}-\frac{2}{\infty^2}}$

$\Rightarrow 0$

6. $\lim_{x\to 0} \frac{f(x)-f(a)}{x-a}$; $\lim_{t\to 0} \frac{f(a+t)-f(a)}{t}$

A (i) $f(x) = x^2, a = 3$

$\lim_{x\to 0} \frac{x^2-a^2}{x-a}$

$\lim_{x\to 0} \frac{(x-a)(x+a)}{x-a}$

$\lim_{x\to 0} x + a$

$\Rightarrow 0 + 3 \Rightarrow 3$

ii) $\lim_{t\to 0} \frac{(a+t)^2-(a)^2}{t}$

$\lim_{t\to 0} \frac{a^2+2at+t^2-a^2}{t}$

$\lim_{t\to 0} \frac{t(2a+t)}{t}$

$\lim_{t\to 0} (2a+t)$

$\Rightarrow (2(3)+0)$

$\Rightarrow 6$

B (i) $f(x) = x^2+1, a = 2$

$\lim_{x\to 0} \frac{(x^2+1)-(a^2+1)}{x-a}$

$\lim_{x\to 0} \frac{(x^2+1-a^2-1)}{x-a}$

$\lim_{x\to 0} \frac{x^2-a^2}{x-a}$

$\lim_{x\to 0} \frac{(x-a)(x+a)}{x-a}$

$\lim_{x\to 0} x + a$

$\Rightarrow 0 + 2 \Rightarrow 2$

ii) $\lim_{t\to 0} \frac{(a+t)^2+1-(a^2+1)}{t}$

$\lim_{t\to 0} \frac{a^2+2at+t^2+1-a^2-1}{t}$

$\lim_{t\to 0} \frac{t(2a+t)}{t}$

$\lim_{t\to 0} (2a+t)$

$\Rightarrow (2(2)+0) = 4$

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

$\lim_{x\to 0} \frac{3x^2-x-(3a^2-a)}{x-a}$

$\lim_{x\to 0} \frac{3x^2-x-3a^2+a}{x-a}$

$\lim_{x\to 0} \frac{3x^2-3a^2-(x-a)}{x-a}$

$\lim_{x\to 0} \frac{3(x^2-a^2)-(x-a)}{x-a}$

$\lim_{x\to 0} \frac{3(x+a)(x-a)-(x-a)}{x-a}$

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$$\lim_{x\to 0}\frac{(x-a)(3(x+a)\ -1)}{x-\ a}$$

$$\lim_{x\to 0} 3(x+a)-1$$

⇒ 3(0+0)-1

$$\Rightarrow\ -1$$

ii) $\lim_{t\to 0}\frac{3(a+t)^2-(a+t)-(3a^2-a)}{t}$

$$\lim_{t\to 0}\frac{3a^2+6at+3t^2-a-t-3a^2+a}{t}$$

$$\lim_{t\to 0}\frac{t(6a+3t-1)}{t}$$

$$\Rightarrow\ -1$$

7. $\lim_{x\to a}\frac{x^4-a^4}{x-a}$

$$\lim_{x\to a}\frac{(x^2-a^2)(x^2+a^2)}{x-a}$$

$$\lim_{x\to a}\frac{(x-a)(x+a)(x^2+a^2)}{x-a}$$

$$\lim_{x\to a}(x+a)(x^2+a^2)$$

$$\Rightarrow (a+a)(a^2+a^2)$$

$$\Rightarrow 2a\times 2a^2 \Rightarrow 4a^3$$

$$\lim_{h\to 0}\frac{4(x+h)^3-4x^3}{h}$$

$$\lim_{h\to 0}\frac{4(x^3+3x^2h+3xh^2+h^3)-4x^3}{h}$$

$$\lim_{h\to 0}\frac{4x^3+12x^2h+12xh^2+4h^3-4x^3}{h}$$

$$\lim_{h\to 0}\frac{h(12x^2+12xh+4h^2)}{h}$$

$$\lim_{h\to 0}(12x^2+12xh+4h^2)$$

$$\Rightarrow 12x^2+12x(0)+4(0)^2$$

$$\Rightarrow 12x^2$$

$$\lim_{x\to 0}\frac{1-2^{2x}}{1+2^x}$$

$$\lim_{x\to 0}\frac{(1-2^x)(1+2^x)}{1+2^x}$$

$$\lim_{x\to 0}(1-2^x)$$

$$\Rightarrow 1-2^0$$

$$\Rightarrow 0$$

iv) $\lim_{x\to 0}\frac{x^2-x}{x}$

$$\lim_{x\to 0}\frac{x\ (x-1)}{x}$$

$$\lim_{x\to 0}(x-1)$$

$$\Rightarrow 0-1=-1$$

v) $\lim_{x\to 10}(1-\log_{10}x)$

$$\Rightarrow 1-\log_{10}10$$

$$\Rightarrow 1-1=0$$

CHAPTER 3

1. $f(x)\ =\ \frac{1}{x^2}$

$$f(x+\Delta x)=\frac{1}{(x+\Delta x)^2}$$

$$f'(x)=\lim_{\Delta x\to 0}\frac{f(x+\Delta x)-f(x)}{\Delta x}$$

$$=\lim_{\Delta x\to 0}\frac{\frac{1}{(x+\Delta x)^2}-\frac{1}{x^2}}{\Delta x}$$

$$=\lim_{\Delta x\to 0}\frac{\frac{1}{x^2+2x\Delta x+\Delta x^2}-\frac{1}{x^2}}{\Delta x}$$

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$$= \lim_{\Delta x \to 0} \frac{x^2 - x^2 - 2x\Delta x - \Delta x^2}{(x^2)(\Delta x)(x^2 + 2x\Delta x + \Delta x^2)}$$

$$= \lim_{\Delta x \to 0} \frac{\Delta x(-2x - \Delta x)}{x^2 \Delta x(x^2 + 2x\Delta x + \Delta x^2)}$$

$\Rightarrow \frac{-2x-0}{x^2(x^2+0)}$

$$\Rightarrow \frac{-2x}{x^4}$$

$$f'(x) = \frac{-2}{x^3}$$

2. $f(x) = x^2 + 1$

$$f(x + \Delta x) = (x + \Delta x)^2 + 1$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{(x + \Delta x)^2 + 1 - (x^2 + 1)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{x^2 + 2x\Delta x + \Delta x^2 + 1 - x^2 - 1}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\Delta x(2x + \Delta x)}{\Delta x}$$

$$\Rightarrow 2x + 0 \Rightarrow 2x$$

3. $f(x) = \sin 2x$

$$f(x + \Delta x) = sin2(x + \Delta x)$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{\sin(2x + 2\Delta x) - sin2x}{\Delta x}$$

recall

$$\sin(C + D) = sinCcosD + cosCsinD$$

$$^{-}\sin(C - D) = sinCcosD - cosCsinD$$

$$\Rightarrow \sin(C + D) - \sin(C - D) = 2cosCsinD$$

$$let\ A = C + D; B = C - D$$

$$\frac{A + B}{2} = C;\ \frac{A - B}{2} = D$$

$$\Rightarrow \sin A - \sin B = 2\cos\frac{A + B}{2} sin\frac{A - B}{2}$$

$$where\ A = 2x + 2\Delta x; B = 2x$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{2\cos\frac{A+B}{2} sin\frac{A-B}{2}}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{2\cos\left(\frac{2x+2\Delta x+2x}{2}\right) \sin\left(\frac{2x+2\Delta x-2x}{2}\right)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{2\cos(2x + \Delta x)\, sin\Delta x}{\Delta x}$$

$$= \lim_{\Delta x \to 0} 2\cos(2x + \Delta x) \frac{sin\Delta x}{\Delta x}$$

As limit tends to 0

$$= 2\cos(2x + 0) \times 1 \left(\text{where } 1 = \lim_{\Delta x \to 0} \frac{sin\Delta x}{\Delta x}\right)$$

$$= 2cos2x$$

4. $f(x) = cos2x$

$$f(x + \Delta x) = \cos\ 2(x + \Delta x)$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{cos(2x + 2\Delta x) - cos2x}{\Delta x}$$

$$\cos(C + D) = cosCcosD - sinCsinD$$

$$^{-}\cos(C - D) = cosCcosD + sinCsinD$$

$$\Rightarrow \cos(C + D) - \cos(C - D) = -2sinCsinD$$

$$let\ A = C + D; B = C - D$$

$$\frac{A + B}{2} = C;\ \frac{A - B}{2} = D$$

$$cosA - cosB = -2sin\frac{A + B}{2} sin\frac{A - B}{2}$$

$$where\ A = 2x + 2\Delta x; B = 2x$$

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$$f'(x) = \lim_{\Delta x \to 0} \frac{-2\sin\frac{A+B}{2} \sin\frac{A-B}{2}}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{-2\sin\left(\frac{2x+2\Delta x+2x}{2}\right)\sin\left(\frac{2x+2\Delta x-2x}{2}\right)}{\Delta x}$$

$$= -2\lim_{\Delta x \to 0} \frac{\sin(2x+\Delta x)\, sin\Delta x}{\Delta x}$$

$$= -2\lim_{\Delta x \to 0} \sin(2x+\Delta x)\frac{sin\Delta x}{\Delta x}$$

As limit tends to 0

$$= -2\sin(2x+0) \times 1 \left(\text{where } 1 = \lim_{\Delta x \to 0} \frac{sin\Delta x}{\Delta x}\right)$$

$$= -2sin2x$$

5. $f(x) = x^2 + 3x + 1$

$$f(x+\Delta x) = (x+\Delta x)^2 + 3(x+\Delta x) + 1$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{(x+\Delta x)^2 + 3(x+\Delta x) + 1 - (x^2+3x+1)}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{x^2+2x\Delta x+\Delta x^2+3x+3\Delta x+1-x^2-3x-1}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{\Delta x(2x+\Delta x+3)}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \to 0} (2x+\Delta x+3)$$

$$= (2x+0+3)$$

$$= 2x+3$$

6. $f(x) = \frac{x}{x+1}$

$$f(x+\Delta x) = \frac{x+\Delta x}{x+\Delta x+1}$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{\frac{x+\Delta x}{x+\Delta x+1} - \frac{x}{x+1}}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{\frac{(x+\Delta x)(x+1) - x(x+\Delta x+1)}{(x+\Delta x+1)(x+1)}}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{x^2+x+x\Delta x+\Delta x-x^2-x\Delta x-x}{\Delta x(x+\Delta x+1)(x+1)}$$

$$= \lim_{\Delta x \to 0} \frac{\Delta x}{\Delta x(x+\Delta x+1)(x+1)}$$

$$= \lim_{\Delta x \to 0} \frac{1}{(x+\Delta x+1)(x+1)}$$

$$\Rightarrow \frac{1}{(x+0+1)(x+1)}$$

$$\Rightarrow \frac{1}{(\mathrm{x}+1)^2}$$

7. $f(x) = \tan 2x$

$$f(x+\Delta x) = tan\ 2(x+\Delta x)$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{tan\ (2x+2\Delta x) - tan2x}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{\frac{sin\ (2x+2\Delta x)}{cos\ (2x+2\Delta x)} - \frac{sin2x}{cos2x}}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{\frac{sin(2x+2\Delta x)cos2x - cos(2x+2\Delta x)sin2x}{cos\ (2x+2\Delta x)cos2x}}{\Delta x}$$

$recall, \sin(A-B) = sinAcosB - cosAsinB$

$let\ A = 2x+2\Delta x; B = 2x$

$\sin(2x+2\Delta x-2x) \Rightarrow sin2\Delta x$

$\Rightarrow sin(2x+2\Delta x)cos2x - \cos(2x+2\Delta x)\, sin2x$

$$\therefore f'(x) = \lim_{\Delta x \to 0} \frac{sin2\Delta x}{\Delta x cos\ (2x+2\Delta x)cos2x}$$

$recall, sin2\Delta x = 2sin\Delta x cos\Delta x$

$$\Rightarrow \lim_{\Delta x \to 0} \frac{2sin\Delta x cos\Delta x}{\Delta x cos\ (2x + 2\Delta x)cos2x}$$

$$recall, \lim_{\Delta x \to 0} \frac{sin\Delta x}{\Delta x} = 1$$

$$\Rightarrow 2 \times 1 \times \frac{\cos 0}{\cos\left(2x + 2(0)\right)\cos 2x}$$

$$= 2 \times \frac{1}{\cos^2 2x}$$

$$= 2\sec^2 2x$$

8. $f(x) = x(x^2 + 2x)$

$f(x + \Delta x) = (x + \Delta x)((x + \Delta x)^2 + 2(x + \Delta x))$

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{(x+\Delta x)\left((x+\Delta x)^2 + 2(x+\Delta x)\right) - x(x^2+2x)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{(x+\Delta x)(x^2+2x\Delta x+\Delta x^2+2x+2\Delta x) - x^3 - 2x^2}{\Delta x}$$

$$= == \lim_{\Delta x \to 0} \frac{x^3+2x^2\Delta x+x\Delta x^2+2x^2+2x\Delta x+x^2\Delta x+2x\Delta x^2+\Delta x^3+2x\Delta x+2\Delta x^2-x^3-2x^2}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\Delta x(2x^2+x\Delta x+2x+x^2+2x\Delta x+\Delta x^2+2x+2\Delta x)}{\Delta x}$$

$$\Rightarrow 3x^2 + 3x(0) + 4x + (0)^2 + 2(0)$$

$$\Rightarrow 3x^2 + 4x$$

Exercise 2

1. $y = x^3 - 9x^2 + 24x$

$y' = 3x^2 - 18x + 24$

$3x^2 - 18x + 24 = 0$

$x^2 - 6x + 8 = 0$

$x^2 - 4x - 2x + 8 = 0$

$x(x - 4) - 2(x - 4) = 0$

$(x - 4)(x - 2) = 0$

$x = 4\ or\ x = 2$

$for\ x = 4\ choose\ the\ interval\ [3,5]$

$f(4) = 4^3 - 9(4)^2 + 24(4)$

$= 64 - 144 + 96$

$= 16$

$f(3) = 3^3 - 9(3)^2 + 24(3)$

$= 27 - 81 + 72$

$= 18$

$f(5) = 5^3 - 9(5)^2 + 24(5)$

$= 125 - 225 + 120$

$= 20$

$since\ f(4) < f(3), f(4) < f(5);$

$a\ local\ minimum\ occurs\ at\ f(4)$

$for\ x = 2\ choose\ the\ interval\ [1,3]$

$f(2) = 2^3 - 9(2)^2 + 24(2)$

$= 8 - 36 + 48$

$= 20$

$f(1) = 1^3 - 9(1)^2 + 24(1)$

$= 1 - 9 + 24$

$= 16$

$f(3) = 3^3 - 9(3)^2 + 24(3)$

$= 27 - 81 + 72$

$= 18$

$since\ f(2) > f(1), f(2) > f(1);$

$a\ local\ maximum\ occurs\ at\ f(2)$

b) $y = x^4 - 2x^2 + 3$

$y' = 4x^3 - 4x$

$4x^3 - 4x = 0$

$4x(x^2 - 1) = 0$

$4x = 0\ or\ x^2 - 1 = 0$

$x = 0\ or\ x = \pm 1$

$for\ x = 0\ choose\ the\ interval\ [-1,1]$

$f(0) = 0^4 - 2(0)^2 + 3$

$= 3$

$f(-1) = (-1)^4 - 2(-1)^2 + 3$

$= 1 - 2 + 3$

$= 2$

$f(1) = (1)^4 - 2(1)^2 + 3$

$= 1 - 2 + 3$

$= 2$

$since\ f(0) > f(-1) \&\ f(0) > f(1);$

$a\ local\ maximum\ occurs\ at\ x = 0$

$for\ x = -1\ choose\ the\ interval\ [0,-2]$

$f(-1) = (-1)^4 - 2(-1)^2 + 3$

$= 1 - 2 + 3$

$= 2$

$f(0) = 0^4 - 2(0)^2 + 3$

$= 3$

$f(-2) = (-2)^4 - 2(-2)^2 + 3$

$= 16 - 8 + 3$

$= 11$

$since\ f(-1) < f(0), f(-1) < f(-2);$

$a\ local\ minimum\ occurs\ at\ x = -1$

$for\ x = 1\ choose\ the\ interval\ [0,2]$

$f(1) = (1)^4 - 2(1)^2 + 3$

$= 1 - 2 + 3$

$= 2$

$f(0) = 0^4 - 2(0)^2 + 3$

$= 3$

$f(2) = (2)^4 - 2(2)^2 + 3$

$= 16 - 8 + 3$

$= 11$

$since\ f(1) < f(0); f(1) < f(2)$

$a\ local\ minimum\ occurs\ at\ x = 1$

Exercise 3

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

$given\ the\ interval\ [1,2]$

$$f(1) = \frac{1^2}{1+1} = \frac{1}{2}$$

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

$$recall, \frac{f(b) - f(a)}{b - a} = f'(c)$$

$$\frac{4/3 - 1/2}{2 - 1} = \frac{\frac{8-3}{6}}{1}$$

$$= \frac{5}{6} = f'(c)$$

$$f'(x) = \frac{(x+1)(2x) - x^2(1)}{(x+1)^2}$$

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

$$=\frac{x^2+2x}{(x+1)^2}$$

$f'(c)=\frac{c^2+2c}{(c+1)^2}=\frac{5}{6}$

$6(c^2+2c)=5(c^2+2c+1)$

$6c^2+12c=5c^2+10c+5$

$c^2+2c-5=0$

$$c=\frac{-2\pm\sqrt{4+20}}{2}$$

$$=\frac{-2\pm\sqrt{24}}{2}$$

$$=\frac{-2\pm 2\sqrt{6}}{2}$$

$=-1+\sqrt{6}$ or $-1-\sqrt{6}$

since $-1+\sqrt{6}$ *is within the interval* ;

the value of c that would satisfy $\boldsymbol{y}$ *is*
$-1+\sqrt{6}$

2. $x^2-x^3 \quad -2\leq x\leq 1$

the equation satisfies the condition for MVT

$f(-2)=(-2)^2-(-2)^3=12$

$f(1)=1^2-1^3=0$

$$f'(c)=\frac{0-12}{1--2}$$

$$=\frac{-12}{3}$$

$=-4$

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

$f'(c)=2c-3c^2=-4$

$3c^2-2c-4=0$

$$c=\frac{--2\pm\sqrt{(-2)^2-4(3\times-4)}}{2(3)}$$

$$c=\frac{2\pm\sqrt{52}}{6}$$

$$=\frac{1\pm\sqrt{13}}{3}$$

since the value of c within the given boundary is $\frac{1-\sqrt{13}}{3}$;
that is the value of c that will satisfy $f(x)$

3. $g(x)=3x^3-9x^2-3x \quad -2\leq x\leq 3$

the equation satisfies the conditions for MVT

$g(-2)=3(-2)^3-9(-2)^2-3(-2)$

$=-24-36+6$

$=-54$

$g(3)=3(3)^3-9(3)^2-3(3)$

$=81-81-9$

$=-9$

$$\frac{-9--54}{3--2}=9=g'(c)$$

$g'(x)=9x^2-18x-3$

$g'(c)=9c^2-18c-3$

$9c^2-18c-3=9$

$9c^2-18c-12=0$

solving quadratically;

$c=2.53$ *and* -0.53

The both values of c gotten are

ADEBAICY

selected beacuse it falls within the given interval

Exercise 4

1. $f(x) = x^3 - 6x^2 + 12x - 8$

$f'(x) = 3x^2 - 12x + 12$

$f'(x) > 0$

$3x^2 - 12x + 12 > 0$

$x^2 - 4x + 4 > 0$

$x^2 - 2x - 2x + 4 > 0$

$\Rightarrow x > 2$

$\therefore f \text{ is increasing in } (2, \infty)$

$f'(x) < 0$

$\Rightarrow x < 2$

$\therefore f \text{ is decreasing in } (-\infty, 2)$

2. $f(x) = 3x^3 - 6x^2$

$f'(x) = 9x^2 - 12x$

$f'(x) > 0$

$9x^2 - 12x > 0$

$3x^2 - 4x > 0$

$x(3x - 4) > 0$

$\Rightarrow x > 0 \text{ and } x > \frac{4}{3} \text{ or } x < 0 \text{ and } x < \frac{4}{3}$

$\therefore f \text{ is increasing in } [-\infty, 0] \& [{}^{4}/_{3}, \infty]$

$f'(x) < 0$

$\Rightarrow x > 0 \text{ and } x < \frac{4}{3} \text{ or } x < 0 \text{ and } x > \frac{4}{3}$

$\therefore f \text{ is decreasing in } [0, {}^{4}/_{3}]$

3. $f(x) = x^2 - 6x$

$f'(x) = 2x - 6$

$f'(x) > 0$

$2x - 6 > 0$

$\Rightarrow x > 3$

$\therefore f \text{ is increasing in } [3, \infty]$

$f'(x) < 0$

$\Rightarrow x < 3$

$\therefore f \text{ is decreasing in } [-\infty, 3]$

4. $f(x) = x^4 - 8x^3 + 10x^2 + 40$

$f'(x) = 4x^3 - 24x^2 + 20x$

$f'(x) > 0$

$x(x^2 - 6x + 5) > 0$

$x(x^2 - 5x - x + 5) > 0$

$x\big(x(x-5) - 1(x-5)\big) > 0$

$x(x-1)(x-5) > 0$

$\Rightarrow x > 0; x > 1; x > 5 \text{ or}$

$x < 0; x < 1; x < 5$

$\therefore f \text{ is increasing in } [5, \infty] \text{ and } [0, -1]$

$f'(x) < 0$

$\Rightarrow x > 0; x < 1 \text{ or } x < 0; x > 1$

$\Rightarrow x > 1; x < 5 \text{ or } x < 1; x > 5$

$\therefore f \text{ is decreasing in } [1,5] \text{ and } [-\infty, 0]$

CHAPTER 4

EXERCISE 1

1. $y = e^{5x}(3x+1)$

using product rule

$u = e^{5x}\ ; v = 3x+1$

$$\frac{du}{dx} = 5e^{5x}$$

$$\frac{dv}{dx} = 3$$

$$recall, \frac{dy}{dx} = v\frac{du}{dx} + u\frac{dv}{dx}$$

$$\frac{dy}{dx} = (3x+1)5e^{5x} + e^{5x}(3)$$

$$= e^{5x}(15x+5+3)$$

$$\frac{dy}{dx} = e^{5x}(15x+8)$$

2. $y = xcos2x$

$u = x; v = cos2x$

$w = 2x; v = cosw$

$$\frac{dv}{dx} = \frac{dv}{dw} \times \frac{dw}{dx}$$

$$= -\sin w \times 2$$

$$= -2sinw$$

$$= -2sin2x$$

$$\frac{du}{dx} = 1$$

$$\frac{dy}{dx} = v\frac{du}{dx} + u\frac{dv}{dx}$$

$$= cos2x(1) + x(-2sin2x)$$

$$= cos2x - 2xsin2x$$

3. $y = x^3 sin5x^2$

$u = x^3\ ; v = sin5x^2$

$w = 5x^2; v = \sin w$

$$\frac{dv}{dx} = \frac{dv}{dw} \times \frac{dw}{dx}$$

$$= \cos w\ \times 10x$$

$$= 10xcos5x^2$$

$$\frac{du}{dx} = 3x^2$$

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

$$= (sin5x^2)(3x^2) + x^3(10xcos5x^2)$$

$$= 3x^2sin5x^2 + 10x^4cos5x^2$$

4. $y = x^2 \cos^2 x$

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

$v = \cos^2 x$

$w = \cos x; v = w^2$

$$\frac{dv}{dx} = \frac{dv}{dw} \times \frac{dw}{dx}$$

$$= 2w \times -sinx$$

$$= 2(cosx)(-sinx)$$

$$= -sin2x$$

$$\frac{dy}{dx} = v\frac{du}{dx} + u\frac{dv}{dx}$$

$$\frac{dy}{dx} = \cos^2 x(2x) + (x^2)(-sin2x)$$

$$\frac{dy}{dx} = 2xcos^2x - x^2sin2x$$

$$\frac{dy}{dx} = x(2\cos^2 x - xsin2x)$$

QUOTIENT RULE

1. $y = \frac{sinx}{cos9x}$

$u = sinx; v = cos9x$

$\frac{du}{dx} = cosx; \frac{dv}{dx} = -9sin9x$

$$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{du}{dx}}{v^2}$$

$$= \frac{(cos9x)(\cos x) - (sinx)(-9sin9x)}{(cos9x)^2}$$

$$= \frac{cos9xcosx + 9sinxsin9x}{(cos9x)^2}$$

2. $y = \frac{sin2x}{2x+5}$

$u = sin2x; v = 2x + 5$

$\frac{du}{dx} = 2cos2x; \frac{dv}{dx} = 2$

$$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

$$= \frac{(2x+5)(2\cos 2x) - (sin2x)(2)}{(2x+5)^2}$$

$$= \frac{2((2x+5)cos2x - sin2x)}{(2x+5)^2}$$

3. $y = \frac{(3x+1)cos2x}{e^{2x}}$

$v = e^{2x}; \frac{dv}{dx} = 2e^{2x}$

$u = (3x+1)cos2x$

$w = 3x + 1; z = cos2x$

$u = wz$

$\frac{dw}{dx} = 3; \frac{dz}{dx} = -2sin2x$

$\frac{du}{dx} = w\frac{dz}{dx} + z\frac{dw}{dx}$

$= (3x+1)(-2sin2x) + (cos2x)3$

$= 3cos2x - 2(sin2x)(3x+1)$

$$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

$$= \frac{(e^{2x})\big(3cos2x - 2(sin2x)(3x+1)\big) - (3x+1)(cos2x)(2e^{2x})}{(e^{2x})^2}$$

$$= \frac{\big(3cos2x - 2(sin2x)(3x+1)\big) - (3x+1)(2cos2x)}{e^{2x}}$$

4. $y = \frac{xsinx}{1+cosx}$

$u = xsinx; v = 1 + cosx$

$\frac{dv}{dx} = -sinx$

$u = xsinx$

$w = x; \frac{dw}{dx} = 1$

$z = sinx; \frac{dz}{dx} = cosx$

$\frac{du}{dx} = xcosx + sinx$

$$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

$$= \frac{(1+cosx)(xcosx+sinx) - (xsinx)(-sinx)}{(1+cosx)^2}$$

$$= \frac{(1+cosx)(xcosx+sinx) + xsin^2x}{(1+cosx)^2}$$

5. $y = \frac{e^{4x}sinx}{xcos2x}$

$u = e^{4x}sinx$

$a = e^{4x}; b = sinx$

$\frac{da}{dx} = 4e^{4x}; \frac{db}{dx} = cosx$

ADEBAICY

$$\frac{du}{dx} = e^{4x}(\cos x) + sinx(4e^{4x})$$

$$= e^{4x}(cosx + 4sinx)$$

$$v = xcos2x$$

$$c = x; d = cos2x$$

$$\frac{dc}{dx} = 1; \frac{dd}{dx} = -2sin2x$$

$$\frac{dv}{dx} = x(-2sin2x) + cos2x$$

$$= cos2x - 2xsin2x$$

$$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

$$= \frac{(xcos2x)\left(e^{4x}(cosx + 4sinx)\right) - e^{4x}sinx(cos2x - 2xsin2x)}{(xcos2x)^2}$$

6. $y = \frac{x^4}{(x+1)^2}$

$$u = x^4; \frac{du}{dx} = 4x^3$$

$$v = (x+1)^2$$

$$w = x + 1; v = w^2$$

$$\frac{dv}{dx} = \frac{dv}{dw} \times \frac{dw}{dx}$$

$$= 2w \times 1$$

$$= 2(x+1)$$

$$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

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

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

EXERCISE 3

1. $y = \frac{e^{4x}}{x^3cosh3x}$

take In of both sides

$$In\, y = In\, e^{4x} - In\, x^3 - In\, cosh3x$$

differentiating wrt x

$$\frac{1}{y}.\frac{dy}{dx} =$$

$$\frac{1}{e^{4x}}.4e^{4x} - \frac{1}{x^3}.3x^2 - \frac{1}{cosh3x}.3sinh3x$$

$$\frac{dy}{dx} = \frac{e^{4x}}{x^3cosh3x}[4 - \frac{3}{x} - 3tanh3x]$$

2. $y = \frac{(3x+1)cos2x}{e^{2x}}$

take In of both sides

$$In\, y = In\,(3x+1) + In\, cos2x - In\, e^{2x}$$

differentiating wrt x

$$\frac{1}{y}.\frac{dy}{dx} =$$

$$\frac{1}{3x+1}.3 + \frac{1}{cos2x}.(-2sin2x) - \frac{1}{e^{2x}}.2e^{2x}$$

$$\frac{dy}{dx} = \frac{(3x+1)cos2x}{e^{2x}}[\frac{3}{3x+1} - 2tan2x - 2]$$

3. $y = x^5sin2xcos4x$

take In of both sides

$$In\, y = In\, x^5 + In\, sin2x + In\, cos4x$$

differentiating wrt x

$$\frac{1}{y}.\frac{dy}{dx} =$$

ADEBAYO

$\frac{1}{x^5}.5x^4 + \frac{1}{sin2x}.2cos2x + \frac{1}{cos4x}.-4sin4x$

$\frac{dy}{dx}$

$= x^5sin2xcos4x[\frac{5}{x} + 2cot2x - 4tan4x]$

4. $y = \frac{(x^3-1)sin5x}{x^6}$

$take\ In\ of\ both\ sides$

$In\ y = In\ (x^3 - 1) + In\ sin5x - In\ x^6$

$differentiating\ wrt\ x$

$\frac{1}{y}.\frac{dy}{dx} =$

$\frac{1}{x^3-1}.3x^2 + \frac{1}{sin5x}.5cos5x - \frac{1}{x^6}.6x^5$

$\frac{dy}{dx} = \frac{(x^3-1)sin5x}{x^6}[\frac{3x^2}{x^3-1} + 5cot5x - \frac{6}{x}]$

5. $y = \frac{sin2xcos3x}{cos4x}$

$take\ In\ of\ both\ sides$

$In\ y = In\ sin2x + In\ cos3x - In\ cos4x$

$differentiating\ wrt\ x$

$\frac{1}{y}.\frac{dy}{dx} = \frac{2cos2x}{sin2x} - \frac{3sin3x}{cos3x} + \frac{4sin4x}{\cos 4x}$

$\frac{dy}{dx}$

$= \frac{sin2xcos3x}{cos4x}[2cot2x - 3tan3x +$
$4tan4x]$

EXERCISE 4.

1. $y = \cos(7x + 2)$

$let\ u = 7x + 2; y = \cos u$

$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

$= -sinu \times 7$

$= -7\sin(7x + 2)$

2. $y = (4x - 5)^6$

$let\ u = 4x - 5; y = u^6$

$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

$= 6u^5 \times 4$

$= 24u^5$

$= 24(4x - 5)^6$

3. $y = e^{3-x}$

$let\ u = 3 - x; y = e^u$

$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

$= e^u \times -1$

$= -e^u$

$= -e^{(3-x)}$

4. $y = \sin 2x$

$let\ u = 2x; y = \sin u$

$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

$= cosu \times 2$

$= 2cosu$

$= 2cos2x$

5. $y = \cos(x^2)$

$let\ u = x^2; y = \cos u$

$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

$= -sinu \times 2x$

$= -2x\sin(x^2)$

ADEBAICY

6. $y = In(3 - 4\cos x)$

$let\ u = 3 - 4cosx; y = \ln u$

$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

$= \frac{1}{u} \times 4sinx$

$= \frac{4sinx}{3-4cosx}$

7. $y = e^{sin2x}$

$let\ v = 2x; u = sinv; y = e^{u}$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dv} \times \frac{dv}{dx}$$

$= e^{u} \times \cos v \times 2$

$= 2e^{u} \cos v$

$= 2e^{sin2x} cos2x$

8. check N0. 4

9. $y = \cos^{3}(3x)$

$let\ u = 3x; v = \cos u\,; y = v^{3}$

$$\frac{dy}{dx} = \frac{dy}{dv} \times \frac{dv}{du} \times \frac{du}{dx}$$

$= 3v^{2} \times -\sin u \times 3$

$= -9\cos^{2} usinu$

$= -9\cos^{2} 3x\ sin3x$

10. $y = In\ cos\ 3x$

$let\ u = \cos 3x\,; y = \ln u$

$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

$= \frac{1}{u} \times -3sin3x$

$= \frac{-3sin3x}{cos3x}$

$= -3\tan 3x$

Exercise 5

1. $y = 1 + 2x^{5}$

$y' = 10x^{4}$

$y'' = 40x^{3}$

2. $y = (3x^{2} - 4)^{4}$

$let\ u = 3x^{2} - 4; y = u^{4}$

$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

$= 4u^{3} \times 6x$

$= 24x(3x^{2} - 4)^{3}$

$let\ v = (\ 3x^{2} - 4)^{3}$

$w = x$

$z = 3x^{2} - 4$

$v = z^{3}$

$\frac{dv}{dx} = \frac{dv}{dz} \times \frac{dz}{dx}$

$= 3z^{2} \times 6x$

$= 18x(3x^{2} - 4)^{2}$

$y'' = 24\left(v\frac{dw}{dx} + w\frac{dv}{dx}\right)$

$= 24((\ 3x^{2} - 4)^{3}(1) + x(18x)(3x^{2} - 4)^{2})$

$= 24(3x^{2} - 4)^{2}(\ 21x^{2} - 4)$

3. $y = x^{4} - 8x^{2} + 1$

$y' = 4x^{3} - 16x$

$y'' = 12x^{2} - 16$

4. $y = x^{3} + 7$

$y' = 3x^2$

$y'' = 6x$

5. $y = 2x^3 + 3x^2 - 12x + 20$

$y' = 6x^2 + 6x - 12$

$y'' = 12x + 6$

EXERCISE 6

1. $x^3 + y^3 - 3xy = 8$

$3x^2 + 3y^2y' - 3[xy' + y] = 0$

$3x^2 + 3y^2y' - 3xy' - 3y = 0$

$y'[3y^2 - 3x] = 3y - 3x^2$

$$y' = \frac{3y - 3x^2}{3y^2 - 3x} = \frac{y - x^2}{y^2 - x}$$

2. $x^2 + y^3 - 4x + 4y = 26$

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

$2 + 6yy'' = 0$

$y" = -\frac{2}{6y}$

$= -\frac{1}{3y}$

3. $x^3 + y^3 + 4xy^2 = 5$

$3x^2 + 3y^2y' + 4[x.2yy' + y^2] = 0$

$3y^2y' + 8xyy' = -4y^2 - 3x^2$

$y'[3y^2 + 8xy] = -4y^2 - 3x^2$

$$y' = \frac{-4y^2 - 3x^2}{3y^2 + 8xy}$$

4. $x^2 + y^2 - 5xy^3 + 9 = 0$

$2x + 2yy' - 5[x.3y^2y' + y^3] = 0$

$y'[2y - 15xy^2] = 5y^3 - 2x$

$$y' = \frac{5y^3 - 2x}{2y - 15xy^2}$$

CHAPTER 5

Exercise 1

1. $y = x^2 - x$

$$Area = \int_0^1 y\,dx$$

$$= \int_0^1 (x^2 - x)\,dx$$

$$= \left[\frac{x^3}{3} - \frac{x^2}{2}\right]_0^1$$

$$= \left[\frac{1^3}{3} - \frac{1^2}{2}\right] - \left[\frac{0^3}{3} - \frac{0^2}{2}\right]$$

$$= \frac{1}{3} - \frac{1}{2}$$

$$= \frac{2 - 3}{6}$$

$$= -\frac{1}{6}$$

ADEBAICY

2. $x^2 - 9 = 4 - 7x^2$

$x^2 + 7x^2 = 4 + 9$

$8x^2 = 13$

$x^2 = \frac{13}{8}$

$x = \pm\sqrt{\frac{13}{8}}$

$A = \int_{-\sqrt{\frac{13}{8}}}^{\sqrt{\frac{13}{8}}} (x^2 - 9) - (4 - 7x^2)dx$

$A = \int_{-\sqrt{\frac{13}{8}}}^{\sqrt{\frac{13}{8}}} 8x^2 - 13\,dx$

$= \left[\frac{8x^3}{3} - 13x\right]_{-\sqrt{\frac{13}{8}}}^{\sqrt{\frac{13}{8}}}$

$= [\frac{8\left(\sqrt{\frac{13}{8}}\right)^3}{3} - 13(\sqrt{\frac{13}{8}})]$-$[\frac{8(-\sqrt{\frac{13}{8}})^3}{3} -$
$13(-\sqrt{\frac{13}{8}})\ ]$

$= 5.524 - 16.572 + 5.524 - 16.572$

$= -22.096$

3. The question is faulty

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

$y = -2x - 2$

$4 - 3x - x^2 = -2x - 2$

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

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

$x^2 + x - 6 = 0$

$x^2 + 3x - 2x - 6 = 0$

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

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

$x - 2 = 0\ or\ x + 3 = 0$

$x = 2\ or\ x = -3$

$A = \int_{-3}^{2} (4 - 3x - x^2) - (-2x - 2)dx$

$= \int_{-3}^{2} (4 - 3x - x^2 + 2x + 2)dx$

$= \int_{-3}^{2} (-x^2 - x + 6)dx$

$= \left[\frac{-x^3}{3} - \frac{x^2}{2} + 6x\right]_{-3}^{2}$

$= \left[\frac{-(2)^3}{3} - \frac{(2)^2}{2} + 6(2)\right]$

$- \left[-\frac{(-3)^3}{3} - \frac{(-3)^2}{2} + 6(-3)\right]$

$= \frac{22}{3} - -\frac{27}{2}$

$= \frac{125}{6}$

$= 20\frac{5}{6}$

EXERCISE 2

X	2.1	2.4	2.7	3.0	3.3	3.6
Y	3.2	2.7	2.9	3.5	4.1	5.2

$\int_{2.1}^{3.6} y\,dx$

$\Delta x = \frac{b-a}{n} = \frac{3.6-2.1}{5}$

$= 0.3$

ADEBAICY

$\int_a^b f(x)dx \approx \frac{\Delta x}{2}[f(x_0) + f(x_5) + 2(f(x_1) + f(x_2) + f(x_3) + f(x_4))]$

$\approx \frac{0.3}{2}[3.2 + 5.2 + 2(2.7 + 2.9 + 3.5 + 4.1)]$

≈ 5.22

EXERCISE 3

1. $\int_0^4 x^2\, dx$

$\Delta x = \frac{b-a}{n} = \frac{4-0}{6} = \frac{2}{3}$

S/N	x	x^2	F+L	E	R
1	0	0	0		
2	2/3	4/9		4/9	
3	4/3	16/9			16/9
4	2	4		4	
5	8/3	64/9			64/9
6	10/3	100/9		100/9	
7	4	16	16		
Σ	$\Rightarrow$	$\Rightarrow$	16	140/9	80/9

$A \approx \frac{2}{3} \times \frac{1}{3}[16 + 4\left(\frac{140}{9}\right) + 2\left(\frac{80}{9}\right)]$

$A \approx 21\frac{1}{3}$

2. $\int_0^2 e^{x^2}\, dx$

$\Delta x = \frac{b-a}{n} = \frac{2-0}{6} = \frac{1}{3}$

S/N	x	x^2	e^{x^2}	F+L	E	R
1	0	0	1	1		
2	1/3	1/9	1.118		1.118	
3	2/3	4/9	1.56			1.56
4	1	1	2.718		2.718	
5	4/3	16/9	5.92			5.92
6	5/3	25/9	16.083		16.083	
7	2	4	54.6	54.6		
Σ	$\Rightarrow$	$\Rightarrow$	$\Rightarrow$	55.6	19.919	7.48

$A \approx \frac{1}{9}[55.6 + 4(19.919) + 2(7.48)]$

$A \approx 16.69$

3. $\int_0^2 e^{2x}\, dx$

$\Delta x = \frac{b-a}{n} = \frac{2-0}{6} = \frac{1}{3}$

$A = \frac{\Delta x}{3}[(F + L) + 4E + 2R]$

S/N	x	$2x$	e^{2x}	F+L	E	R
1	0	0	1	1		
2	1/3	2/3	1.948		1.948	
3	2/3	4/3	3.794			3.794
4	1	2	7.389		7.389	
5	4/3	8/3	14.392			14.392
6	5/3	10/3	28.032		28.032	
7	2	4	54.598	54.598		
Σ	$\Rightarrow$	$\Rightarrow$	$\Rightarrow$	55.598	37.369	18.186

$$A \approx \frac{1}{9}[55.598 + 4(37.369) + 2(18.186)]$$

$A \approx 26.827$

4. $\sqrt{1 - x^4}dx$

$\Delta x = \frac{b-a}{n} = \frac{1-0}{6} = \frac{1}{6}$

$A = \frac{\Delta x}{3}[(F + L) + 4E + 2R]$

S/N	x	x^4	$1 - x^4$	$\sqrt{1 - x^4}$
1	0	0	1	1
2	1/6	0.0008	0.9992	0.9996

3	1/3	0.0123	0.9877	0.9938
4	1/2	0.0625	0.9375	0.9682
5	2/3	0.1975	0.8025	0.8958
6	5/6	0.4823	0.5177	0.7195
7	1	1	0	0
Σ	$\Rightarrow$	$\Rightarrow$	$\Rightarrow$	$\Rightarrow$

Table cont'd.....

F+L	E	R
1		
	0.9996	
		0.9938
	0.9682	
		0.8958
	0.7195	
0		
1	2.6873	1.8896

$$A \approx \frac{1/6}{3}[1 + 4(2.6873) + 2(1.8896)]$$

$$A \approx \frac{1}{18}[15.5284]$$

$$A \approx 0.8627$$

1ST EDITION OF CONCISE MTH102 WORKBOOK SOLUTION

APPRECIATION

MY SINCERE APPRECIATION GOES TO ALL LECTURERS IN MATHEMATICS DEPARTMENT, FUOYE

WRITTEN AND COMPILED BY ADEBAICY (ADEJUMO OLUWAPELUMI); AN ENGINEERING STUDENT OF FUOYE

CONTACT:

adebaice@gmail.com,08180228170

SUPPORTED BY:

HON. OMOLUABI (ONITILO ENIOLA)

REFERENCE

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ADEBAICY