AKang Kelvin Nsikak
19/ENG02/003
Computer Engineering
STA 132

Group A

CL	f	x	fx	$(x-\bar{x})$	$(x-\bar{x})^2$	$f(x-\bar{x})^2$
1-5	0	3	0	-17.83	317.91	0
6-10	7	8	56	-9.83	96.63	676.41
11-15	10	13	130	-4.83	23.33	233.3
16-20	2	18	36	0.17	0.03	0.06
21-25	1	23	23	5.17	26.73	26.73
26-30	5	28	140	10.17	103.43	517.15
31-35	4	33	132	15.17	230.13	926.52
	$\Sigma f = 29$		$\Sigma fx = 517$			$\Sigma f(x-\bar{x})^2 = 2374.17$

a)i) Mean $= \frac{\Sigma fx}{\Sigma f} = \frac{517}{29} = 17.83$

ii) Standard deviation $\Rightarrow S.D = \sqrt{\frac{\Sigma f(x-\bar{x})^2}{\Sigma f - 1}}$

$= \sqrt{\frac{2374.17}{28}}$

$= 9.21$

b) Coefficient of variation $\Rightarrow C.V = \frac{S.D}{\bar{x}} \times 100$

$= \frac{9.21}{17.83} \times 100$

$= 51.65$

Integration

2a) $\int 4\sec^2(3m+1)\,dm$

$u = 3m+1$

$du = 3dm$

$dm = \frac{du}{3}$

$= \int 4\sec^2 u \cdot \frac{du}{3}$

$= \frac{4}{3}\int \sec^2 u\,du$

$= \frac{4}{3}\tan u + c$

$= \frac{4}{3}\tan(3m+1) + c$

b) $\int 2t \times (3t^2-1)^{\frac{1}{2}}$

$u = 3t^2 - 1$

$\frac{du}{dt} = 6t$

$\Rightarrow dt = \frac{du}{6t}$

$\int 2t \times u^{\frac{1}{2}} \cdot \frac{du}{6t}$

$\int \frac{1}{3} \times u^{\frac{1}{2}} \cdot du$

$\frac{1}{3}\int u^{\frac{1}{2}} \cdot du$

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

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

$= \frac{2}{9} u^{\frac{3}{2}} + c$

$= \frac{2}{9}(3t^2-1)^{\frac{3}{2}} + c$

c) $\int \frac{2x}{(4x^2-1)^{\frac{1}{2}}} = \int 2x(4x^2-1)^{-\frac{1}{2}} \cdot dx$

$u = 4x^2 - 1$

$du = 8x \cdot dx$

$dx = \frac{du}{8x}$

$= \int 2x(u)^{-\frac{1}{2}} \cdot \frac{du}{8x}$

$= \frac{1}{4}\int u^{-\frac{1}{2}} \cdot du$

$= \frac{1}{4} \times \frac{u^{-\frac{1}{2}+1}}{-\frac{1}{2}+1}$

$= \frac{1}{4} \times \frac{u^{\frac{1}{2}}}{\frac{1}{2}}$

$= \frac{1}{4} \times 2u^{\frac{1}{2}} = \frac{1}{2}u^{\frac{1}{2}} = \frac{1}{2}(4x^2-1)^{\frac{1}{2}} + c$

AKang Kelvin Nsikak
Computer Engineering
19/ENG02/003

MAT 104

Differentiation:

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

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

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

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

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

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

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

b) $y = \dfrac{3e^x \sin 2x}{x^{\frac{5}{2}}}$

$\ln y = (\ln 3e^x + \ln\sin 2x) - \ln x^{\frac{5}{2}}$

$\frac{1}{y}\cdot\frac{dy}{dx} = \left(\frac{1(3e^x)}{3e^x} + \frac{1(\cos 2x)}{\sin 2x}\right) - \frac{1\left(\frac{5}{2}x^{\frac{3}{2}}\right)}{x^{\frac{5}{2}}}$

$\frac{1}{y}\cdot\frac{dy}{dx} = \left(\frac{3e^x}{3e^x} + \frac{\cos 2x}{\sin 2x}\right) - \frac{\frac{5}{2}x^{\frac{3}{2}}}{x^{\frac{5}{2}}}$

$\frac{dy}{dx} = y\left[1 + \frac{\cos 2x}{\sin 2x} - \frac{\frac{5}{2}x^{\frac{3}{2}}}{x^{\frac{5}{2}}}\right]$

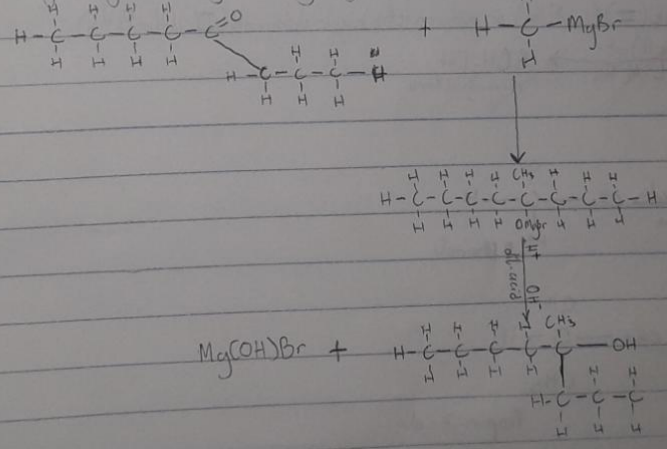
$\frac{dy}{dx} = \frac{3e^x \sin 2x}{x^{\frac{5}{2}}}\left[\left(1 + \frac{\cos 2x}{\sin 2x}\right) - \frac{\frac{5}{2}x^{\frac{3}{2}}}{x^{\frac{5}{2}}}\right]$

AKang Kelvin Nsikak
19/ENG02/003
Computer Engineering
CHM 102

1a) This is based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group ~~to the carbon atom containing the~~ If the numbers of hydrogen atoms attached to the carbon bearing the hydroxyl group are three or two, it is called primary alkanol (1°). If it is one hydrogen atom, it is called secondary alkanol (2°) and if none, it is called tetiary alkanol (3°).
Examples: CH_3OH - methanol (1°), $(CH_3)_3C\text{-}OH$ - 2-methylpropan-2-ol (3°)

b) This is based on the number of hydroxyl groups they possess. Monohydric alcohols have one hydroxyl group present in the alcohol structure. Dihydric alcohols, which are also called glycols, have two hydroxyl groups present in the alcohol fructure while trihydric alcohols or triols have three hydroxyl groups present in the structure of the alcohol. Polyhydric alcohols or polyols have more than three hydroxyl groups.
Examples: $HOCH_2CH_2OH$ - ethane-1,2-diol (dihydric alcohol), $CH_3CH_2CH_2OH$ - propanol (monohydric acid)

2) Grignard Synthesis of Alkanols:
Grignad agent: CH_3MgBr (Methyl magnesium bromide)



3) Carbohydrates such as starch are a major group of natural compounds that can be made to yield ethanol by the biological process of fermentation. The biological catalysts, enzymes, found in yeast, break down the carbohydrate molecules into ethanol to give a yield of 95%. The starch containing materials include molasses, potatoes, cereals, rice and on warming with malt to 60°C for a specific period of time are converted into maltose by the enzyme diastase contained in the malt:

$$2(C_6H_{10}O_5)_n + nH_2O \xrightarrow{60°C/\text{diastase}} nC_{12}H_{22}O_{11}$$

carbohydrate → maltose

The maltose is broken down into glucose on addition of yeast which contains the enzyme maltose and at a temperature of 15°C.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{15°C/\text{maltose}} 2C_6H_{12}O_6$$

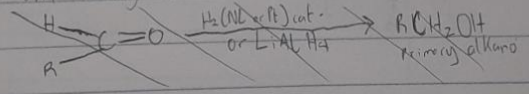
maltose

The glucose at constant temperature of 15°C is then converted into alcohol by the enzyme zymase also contained in yeast:

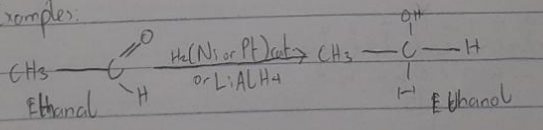
$$C_6H_{12}O_6 \xrightarrow{15°C/\text{zymase}} 2CH_3CH_2OH + 2CO_2$$

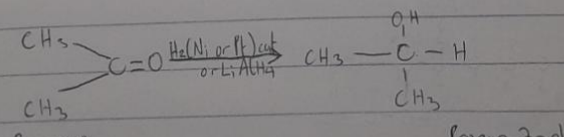
Glucose → Ethanol

4) Alkanals and alkanones are reduced to primary are reduced to primary & secondary alkanols respectively by reaction with hydrogen in the presence of a platinum or nickel catalyst or with aluminium isopropoxide the Meerwein-Ponndorf reaction or with complex metal hydride such as lithium tetrahydridoaluminate(III) ($LiAlH_4$) or sodium tetrahydridoborate(III) ($NaBH_4$)



Examples:





Akang Kelvin N.
19/[redacted]02/003
Computer Engineering
MAT 102

1a) $-3A + 7B - 8C$

$= -3(2i - j) + 7(3i + j + 11k) - 8(4i + 4j - 5k)$

$= -6i + 3j + 21i + 7j + 77k - 32i + 32j + 40k$

$= -6i - 32i + 21i + 3j + 7j - 32j + 77k + 40k$

$= -17i + 22j + 117k$

b) $A \times (B \times C)$

$= 2i - j \times (3i + j + 11k \times 4i + 4j - 5k)$

$= 2i - j \times (12i^2 + 4j^2 - 55k^2)$

$= 24i^3 - 4j^3 - 55k^2$

c) $(3A \times B) \cdot (A \times 2B)$

$= (3(2i - j) \times 3i + j + 11k) \cdot (2i - j \times 2(3i + j + 11k))$

$= (6i - 3j \times 3i + j + 11k) \cdot (2i - j \times (6i + 2j + 22k))$

$= (9i^2 - 3j^2 + 11k)(12i^2 - 2j^2 + 22k)$

$= 108i^4 - 6j^4 - 242k^2$

$= 59i^4 - 3j^4 - 121k^2$

d) $A - 2B - C$

$= 2i - j - 2(3i + j + 11k) - 4i + 4j - 5k$

$= 2i - j - 6i + 2j - 22k - 4i + 4j - 5k$

$= 2i - 6i - 4i - j - 2j + 4j - 22k - 5k$

$= -8i - 7j - 27k$

2a) Two vectors A & B are perpendicular if and only if their scalar product is equal to zero.

b) Coplanar vectors are the vectors which lie in the same plane formed by any two axes in the coordinate geometry.