

Business Mathematics & Statistics for Managers
Scheme & Solution

Q.1	i.	(d) e	+1
	ii.	(a) even function	+1
	iii.	(b) 0	+1
	iv.	(d) $x e^x - e^x + c$	+1
	v.	(b) Random	+1
	vi.	(b) collection of data	+1
	vii.	(c) mutually exclusive	+1
	viii.	(b) $5/18$	+1
	ix.	(b) Forecasting	+1
	x.	(a) Random variation	+1

Q.2	i)	$C(x) = 125000 + 35x$	+1
		$R(x) = 160x$	+1
	(a)	$P(x) = R(x) - C(x)$ $= 125x - 125000$	+1
	(b)	$P(1500) = 187500 - 125000$ $= Rs. 62500$	+1
	(c)	$R(x) = C(x) \quad (\text{B.E.P.})$ $\Rightarrow 125x = 125000$ $\Rightarrow x = 1000 \text{ shoe.}$	+1

(ii) By rationalising

$$\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x} \times \frac{\sqrt{1+x} + \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}}$$

+2

$$= \lim_{x \rightarrow 0} \frac{(1+x) - (1-x)}{x [\sqrt{1+x} + \sqrt{1-x}]} \quad +1$$

$$= \lim_{x \rightarrow 0} \frac{2x}{x [\sqrt{1+x} + \sqrt{1-x}]} \quad +1$$

$$= \cancel{x} \frac{2}{\sqrt{1+0} + \sqrt{1-0}} = 1 \quad +1$$

Q.2 (iii) LHL = $\lim_{x \rightarrow 1^-} f(x) = \lim_{h \rightarrow 0} f(1-h)$

$$= \lim_{h \rightarrow 0} [-2(1-h)^2 + 4] \quad +2$$

$$= \lim_{h \rightarrow 0} [-2(1-2h+h^2) + 4]$$

$$= -2 + 4 = 2$$

RHL = $\lim_{x \rightarrow 1^+} f(x) = \lim_{h \rightarrow 0} f(1+h)$

$$= \lim_{h \rightarrow 0} [(1+h)^2 + 1]$$

$$= 2 \quad +2$$

$$f(1) = 2 \quad (\text{given})$$

$$\therefore f(1) = R.H.L = L.H.L \quad +1$$

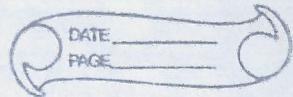
\therefore given funcⁿ is cont. at $x = 1$

Q.3. (i) (a) Formula (Quotient rule) $+1$

$$\frac{dy}{dx} = \frac{(1+x) \frac{d}{dx} e^x - e^x \frac{d}{dx} (1+x)}{(1+x)^2} \quad +1$$

$$= \frac{(1+x)e^x - e^x(1)}{(1+x)^2} = \frac{e^x \cdot x}{(1+x)^2} \quad +0.5$$

Ans



Q.3 (i) (b) $\int_1^2 (3x^2 + 4x^3) dx$

Formula $\int x^n = \frac{x^{n+1}}{n+1}$

$$= \left[3 \frac{x^3}{3} + 4 \frac{x^4}{4} \right]_1^2$$

$$= (x^3 + x^4)_1^2$$

$$= [2^3 + 2^4] - [1^3 + 1^4]$$

$$= 8 + 16 - 2$$

$$= 24 - 2$$

$$= 22$$

+ L

+ L

+ 0.5

Q.3 (ii) (a) $C(x) = \text{Fixed cost} + V \cdot C$

$$= 50,000 + 50x$$

+ 1

(b) $R(x) = p \times x = 75x$

+ 1

(c) $M \cdot C = \frac{d C(x)}{dx} = \frac{d}{dx}(50,000 + 50x)$

$$= 50$$

+ 1

(d) $M \cdot R = \frac{d R(x)}{dx}$

$$= 75$$

+ 1

(e) $R(x) = C(x)$

$$75x = 50x + 50000$$

$$\Rightarrow x = 2000 \text{ books.}$$

+ 1

Q.3 (ii) Given, MC = $f'(x) = 3x^2 + 2x - 1$

$$\Rightarrow C(x) = \int MC dx + k \\ = \int (3x^2 + 2x - 1) dx + k \\ = x^3 + x^2 - x + k$$

$$\therefore f(0) = 0 \text{ i.e. } C(0) = 0$$

$$\Rightarrow k = 0$$

$$\therefore C(x) = x^3 + x^2 - x$$

Thus

$$C(4) = 4^3 + 4^2 - 4 \\ = 64 + 16 - 4 \\ = 76 \text{ units}$$

+1

+1

+1

+2

Q.5 (i)

$$(a) S = \{(1,1), (1,2), (1,3), \dots, (6,5), (6,6)\}$$

$$n(S) = 36$$

+1

$$(i). \text{ Let } A = \{(1,1), (1,2), (2,1), (1,4), (2,3), \\ (3,2), (4,1), (1,6), (2,5), (3,4), \\ (4,3), (5,2), (6,1), (5,6), (6,5)\}$$

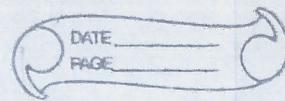
$$P(A) = \frac{n(A)}{n(S)} = \frac{15}{36} \text{ or } \frac{5}{12}$$

+2

$$(ii) \text{ Let } B = \{(1,2), (1,3), (1,4), (1,5), (1,6), \\ (2,3), (2,4), (2,5), (2,6), (3,4), \\ (3,5), (3,6), (4,5), (4,6), (5,6)\}$$

$$P(B) = \frac{n(B)}{n(S)} = \frac{15}{36} \text{ or } \frac{5}{12}$$

+2



Q.5 (ii) Let A, B, C be the events of drawing an item from M_1, M_2, M_3 resp.
& let D be the event of drawing a defective item

Since the drawn item is found to be defective, we have to find that it is manuf. from M_3 i.e. $P\left(\frac{C}{D}\right)$

$$\text{Now } P(A) = \frac{25}{100}, P(B) = \frac{35}{100}, P(C) = \frac{40}{100}$$

$$\text{Also, } P\left(\frac{D}{A}\right) = \frac{5}{100}, P\left(\frac{D}{B}\right) = \frac{4}{100}, P\left(\frac{D}{C}\right) = \frac{2}{100}$$

+1

By Baye's theorem,

$$P\left(\frac{C}{D}\right) = \frac{P(C) \cdot P(D|C)}{P(A) \cdot P\left(\frac{D}{A}\right) + P(B) \cdot P\left(\frac{D}{B}\right) + P(C) \cdot P\left(\frac{D}{C}\right)}$$

+2

$$= \frac{\frac{40}{100} \times \frac{2}{100}}{\dots}$$

+1

$$\frac{\frac{25}{100} \times \frac{5}{100}}{\dots} + \frac{\frac{35}{100} \times \frac{4}{100}}{\dots} + \frac{\frac{40}{100} \times \frac{2}{100}}{\dots}$$

$$= \frac{\frac{80}{125+140+80}}{\dots} = \frac{\frac{80}{345}}{\dots} = \frac{16}{69}$$

$$\text{or } 0.23$$

+1

Q.5 (iii) $N = 800$,
 $n = 4$

$$p = \frac{1}{2}, q = \frac{1}{2}$$

p - prob. of getting a boy
& q - " " " a girl.

Using Binomial distribution,

$$P(x) = {}^n C_x p^x q^{n-x}$$

+1

(a) $P(2 \text{ boys} \& 2 \text{ girls})$

$$= P(x=2)$$

$$= {}^4 C_2 \left(\frac{1}{2}\right)^2 \left(\frac{1}{2}\right)^2 = \frac{6}{16} = \frac{3}{8}$$

$$\text{In \%}, \frac{3}{8} \times 100 = 37.5\%$$

+1

(b) $P(\text{at least one boy})$

$$= P(x=1 \text{ or more})$$

$$= P(x=1) + P(x=2) + P(x=3) + P(x=4)$$

$$= 1 - P(x=0)$$

$$= 1 - \left[{}^4 C_0 \left(\frac{1}{2}\right)^0 \left(\frac{1}{2}\right)^{4-0} \right]$$

$$= 1 - \frac{1}{16} = \frac{15}{16}$$

+1

$$\text{In \%}, \frac{15}{16} \times 100 = 93.75\%$$

(c) $P(\text{no girl}) = P(x=4)$

$$= {}^4 C_4 \left(\frac{1}{2}\right)^4 \left(\frac{1}{2}\right)^{4-4} = \frac{1}{16}$$

$$\text{In \%}, \frac{1}{16} \times 100 = 6.25\%$$

+1

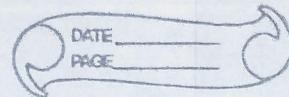
(d) $P(\text{at least 2 girls}) = P(\text{at most 2 boys})$

$$= P(x=2) + P(x=1) + P(x=0)$$

$$= \frac{6}{16} + \frac{4}{16} + \frac{1}{16} = \frac{11}{16}$$

$$\text{In \%}, \frac{11}{16} \times 100 = 68.75\%$$

+1



- Q. 6 (i) writing name of 4 components +1
 (a) Secular trend (linear & non-linear) +1
 (b) Cyclic trend +1
 (c) Seasonal var +1
 (d) Irregular or random +1
 Explain each with example

(ii) Here $n = 6$ (even)

$$x = t - 1987.5$$

Year t	demand y	$x = t - 1987.5$	x^2	xy
1985	200	-2.5	6.25	1500
1986	250	-1.5	2.25	-375
1987	275	-0.5	0.25	-137.5
1988	340	0.5	0.25	170
1989	410	1.5	2.25	615
1990	500	2.5	6.25	1250
1975	0	17.50	1022.5	

+2

$$\sum y = 1975, \sum x = 0, \sum x^2 = 17.50, \sum xy = 1022.5$$

Let the trend be $y = a + bx$
 & normal eqns are

$$\sum y = na + b \sum x$$

$$\sum xy = a \sum x + b \sum x^2$$

+1

putting all values,

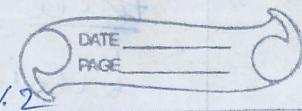
$$1975 = 6a + b \times 0 \Rightarrow a = 329.17$$

$$\text{&} 1022.5 = 0 + 17.50b \Rightarrow b = 58.42$$

} +1

$$\text{Thus } y = 329.17 + 58.42x$$

+1



1/4

1/2

Q. 6 (iii) Year	Imp. cotton (in '000)	4 yearly moving total	4 yearly moving avg.	Centered moving avg.
1970	129	-	-	-
1975	131	-	-	-
	-	457	114.25	-
1980	106	-	-	110
	-	423	105.75	-
1985	91	-	-	99.875
	-	376	94.00	-
1990	95	-	-	92.375
	-	363	90.75	-
1995	84	-	-	-
2000	93	-	-	-

OR ↑
+1↑
+2↑
+2
+1.81

+5

Year	Imp. cotton	4 yearly moving total	Centered moving total	4 year moving average
1970	129	-	-	-
1975	131	-	-	-
	-	457	-	-
1980	106	-	880	110.
	-	423	-	-
1985	91	-	799	99.875
	-	376	-	-
1990	95	-	739	92.375
	-	363	-	-
1995	84	-	-	-
2000	93	-	-	-
2000	93	↑ +1	↑ +2	↑ +2

08

- Q.4 (i) Students are required to explain any three applications of statistics in business management (+1 for each) writing two examples +3
+2
- (ii) Students are required to discuss this defⁿ at each stage.
 collection +1
 presentation +1
 comparison (analysis) +1
 interpretation +1
 & give example in each +1
- (iii) Explaining concept of population with example +2.5
- Explaining concept of sample with example. +2.5
-