(GCF-19, GCF-20, GCF-21, GCF-22, GCF-23, VCF-4, SCF-8, NOV-20 PD & GD, Foundation Nov. 19 Rep.)

DATE: 10.08.2020 **MAXIMUM MARKS: 100** **TIMING: 2 Hours**

BUSINESS MATHEMATICS, REASONING & STATISTICS

1. Ans. a
Explanation:
P_1=x, P_2 = 20,000-x
$$\frac{x \times 8 \times 1}{100} + \frac{(20{,}000 - x) \times 4 \times 1}{300} = 800$$
x = 8,000

2. Ans. b
$$CI = P\left(1 + \frac{r}{100}\right)^n - P$$
$$2{,}59{,}712 = 10{,}00{,}000\left(1 + \frac{8}{100}\right)^n - 10{,}00{,}000$$
$1.259712 = (1.08)^n$
n = 3 years

3. Ans. b
Explanation:
$$\begin{bmatrix} x+xy & 2x+y^2 & 3x+yz \\ 2+3x & 4+3y & 6+3z \end{bmatrix}$$

4. Ans. c
Explanation:
Region represented by the line 3x + 2y = 24 meets the coordinate axes at (8,0) and (0,12). Since the shaded region lies below the line 3x+2y=24 therefore it is represented by less than or equal to sign i.e. $3x+2y \leq 24$.
Similarly for th eline x+2y = 16 the shaded region lies below the line therefore it is represented by less than or equal to sign i.e. $x+2y \leq 16$
Clearly $X \geq 0$ and $y \geq 0$ represents the region lying on the right side of y axis and above x axes.

5. Ans. d
Explanation:
No. of ways = $^7C_4 \times {}^3C_2 + {}^7C_3 \times {}^3C_3$
= 105 + 35 = 140

6. Ans. d
Explanation:
$(a, a), (b, b), (c, c) \in R$
So R is a reflexive relation
But $(a, b) \in R$ and $(b, a) \notin R$
Thus, R is not a symmetric relation.

Also, $(a, b), (b, c) \in R \Rightarrow (a, c) \notin R$
Hence R is not a transitive relation

7. Ans. a
Explanation:

Present value of growing property = $\frac{R}{i-g}$

$$= \frac{60}{0.07 - 0.05} = 3000$$

8. Ans. c

$SI = \frac{\Pr t}{100}$

$$\frac{1800 \times 4 \times t}{100} - \frac{1650 \times 4 \times t}{100} = 30$$

t = 5 years

9. Ans. b
Explanation:

$^{n+2}Cr = {}^{n+2}C_{10-r}$

or $n + 2 = r + 10 - r$

or n = 8

then $8_{C_6} = \boxed{28}$

10. Ans. a

$\log_5^{1024}$

$$= \frac{\log^{1024}}{\log_5}$$

$$= \frac{10 \log^2}{\log_5}$$

$$= \frac{10 \log^2}{\log_{10} - \log_2} = \frac{10 \times 0.3010}{1 - 0.3010}$$

11. Ans. a

$A = P\left(1 + \frac{r}{100}\right)^n$

$A = 50{,}000\left(1 + \frac{2}{100}\right)^2$

= 52,020

12. Ans. b
Mean Proportion
$$= \sqrt{\frac{a-b}{a+b} \times \frac{a^2\ b^2}{a^2-b^2}}$$
$$= \frac{ab}{a+b}$$

13. Ans. c
Explanation:
$$A^{-1} = \frac{adj(A)}{|A|}$$
$$\text{adj } A = \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix}^T$$
$$= \begin{bmatrix} 2 & -3 \\ 2 & 1 \end{bmatrix}^T$$
$$= \begin{bmatrix} 2 & 2 \\ -3 & 1 \end{bmatrix}$$
$|A| = 2 - (-6) = 2 + 6 = 8$
$$A^{-1} = \frac{1}{8} \begin{bmatrix} 2 & 2 \\ -3 & 1 \end{bmatrix}$$
$$= \begin{bmatrix} 1/4 & 1/4 \\ -3/8 & 1/8 \end{bmatrix}$$

14. Ans. c
100----------→ 200----------→ 400----------→
5 yrs. 5 yrs. 5 yrs.
Total = 15 years.

15. Ans. d

Income	Expenses	Savings
100	75	25
120	82.5	37.5

% increase in his savings $= \frac{37.5 - 25}{25} \times 100$
= 50

16. Ans. c
Explanation:
$$\int \frac{8^{1+x} + 4^{1-x}}{2^x} dx$$

$$= \int \frac{2^{3x+3} + 2^{2-2x}}{2^x} dx$$

$$= \int \left(2^{2x+3} + 2^{2-3x}\right) dx$$

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

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

17. Ans. b

$$A = P\left(1 + \frac{rt}{100}\right)$$

$$180 = 100\left(1 + \frac{r \times 8}{100}\right)$$

r = 10%

$$CI = 14{,}000\left(1 + \frac{10}{100}\right)^3 - 14{,}000 = 4{,}634$$

18. Ans. b
Let the three consecutives
Multiples of 13 is
13x, 13x+13, 13x+26
13x + 13x + 13 + 13x + 26 = 390
39x + 39 = 390
39x = 351
x = 9
Second Multiple of 13 = 13x + 13
= 13x9 + 13
= 130

19. Ans. b
Explanation:
T_5= a+4d =14 ..... (i)
T_{12} = a+11d =35 ..... (ii)
On solving equation (i) and (ii)
a=2

20. Ans. d
Explanation:

$$A = \frac{P}{r}\left[(1+r)^n - 1\right]$$

Here $r = \frac{6}{100 \times 4} = 0.015$

$n = 5 \times 4 = 20$

Now $50,000 = \frac{P}{0.015}\left[\ 1.015\ ^{20} - 1\right]$

$= \frac{P}{0.015}\ 1.346 - 1$

$P = \frac{50,000 \times 0.15}{0.346}$

P = Rs. 2162.2866

21. Ans. c
Explanation:
Total line can be made by 10_{C_2}
and 7_{C_2} lines could not be drawn because points are collinear
So Remaining $\Rightarrow 10_{C_2} - 7_{C_2} + 1$
$\Rightarrow$ 25

22. Ans. a
Explanation :
$f(x) = (x-1)^3 + 2$ (bijection function)
Let $(x-1)^3 + 2 = y$
$(x-1)^3 = y - 2$
$x = (y-2)^{1/3} + 1$
So $f^{-1} = (x-2)^{1/3} + 1$

23. Ans. a
Explanation:
$2x^2 + 5xy + 3y^2 = 1$
$4x + 5x\frac{dy}{dx} + 5y + 6y\frac{dy}{dx} = 0$
$\frac{dy}{dx} = \frac{-4x - 5y}{5x + 6y}$

24. Ans. c
Explanation:
Let us denote by x, the number of bags of fertilizers of grade I and by y, the number of bags of fertilizers of grade II produced in a week. We are given that grade I fertilizer requires 6 hours in plant A and grade II fertilizer requires 3 hours in plant A and plant A has maximum of 120 hours available in a week. Thus $6x + 3y \leq 120$.
Similarly grade I fertilizer requires 4 hours in plant B and grade II fertilizer requires 10 hours in Plant B and Plant B has maximum of 180 hours available in a week. Hence, we get the inequality $4x + 10y \leq 180$.

25. Ans. c
Explanation:
$x^2 + x + 2 = 0$
$\propto + \beta = -1, \propto \beta = 2$
$(\propto + \beta)^2 = \propto^2 + \beta^2 + 2 \propto \beta$
$1 = \propto^2 + \beta^2 + 4$
$\propto^2 + \beta^2 = -3$

$$\frac{\propto}{\beta} + \frac{\beta}{\propto} = \frac{\propto^2 + \beta^2}{\propto \beta} = \frac{-3}{2}$$

26. Ans. d
Explanation:
The required no. of ways = 4!×3! = 144

27. Ans. c
Explanation:
The no. of ways $= {}^4P_3 \times 4!$
$= 24 \times 24 = 576$

28. Ans. b
Explanation:
$\log\left(a + \sqrt{a^2 + 1}\right) + \log\left(a + \sqrt{a^2 + 1}\right)^{-1}$
$= \log\left(a + \sqrt{a^2 + 1}\right) - \log\left(a + \sqrt{a^2 + 1}\right)$
$= 0$

29. Ans. c
Explanation:
a=132 , l = 468
l = a +(n-1)d
468 = 132 + (n-1)(12)
n =29

$S_n = \frac{n}{2}(a + l)$

$S_{29} = \frac{29}{2}(132 + 468) = 8700$

30. Ans. b
Explanation:

$$P = \frac{R}{r} = \frac{30,000}{0.58} = 5,17,241.38$$

31. Ans. a
Explanation:

Scrap Value = $P(1 - \frac{r}{100})^n$

$21,870 = P\ (.9)^3$
P = Rs. 30,000

32. Ans. d
Explanation:

$$E = \left[\left(1 + \frac{9.9}{1200}\right)^{12} - 1\right] x\ 100$$

= 10.36%

33. Ans. a
Explanation:
CI – SI = 372

$$P\left(1 + \frac{r}{100}\right)^{n} - P - \frac{Prt}{100} = 372$$

$$P\left(1 + \frac{10}{100}\right)^{2} - P - \frac{P x 10 x 2}{100} = 372$$

P = 37,200

34. Ans. a
Explanation:

$$A = P\left(1 + \frac{r}{100}\right)^{n}$$

$$2{,}00{,}000 = P\left(1 + \frac{5}{100}\right)^{2}$$

P = Rs. 1.81 Lakh

35. Ans. b
Explanation:

$$2^{a} = 3^{b} = 12^{c} = k$$

2 x 2 x 3 = 12

$k^{1/a} \times k^{1/a} \times k^{1/b} = k^{1/c}$

$$\frac{2}{a} + \frac{1}{b} = \frac{1}{c}$$

$$\frac{2b + a}{ab} = \frac{1}{c}$$

ab = c (a+2b)

36. Ans. c
Explanation:

$$S\infty = \frac{a}{1 - r}$$

$$a = 2,\ b = \frac{6}{5}$$

$$ab = \frac{12}{5}$$

37. Ans. b
Explanation:
$(AUB')'$
$= A' \cap B$
$= B - A$

38. Ans: a
Explanation:

$$\frac{dx}{dt} = \frac{1}{t} \text{ and } \frac{dy}{dt} = -\frac{1}{t^2}$$

$$\Rightarrow \frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{-\frac{1}{t^2}}{\frac{1}{t}} = -\frac{1}{t}$$

$$= -y$$

Differentiating w.r.t. x

$$\frac{d^2y}{dx^2} = -\frac{dy}{dx}$$

$$\Rightarrow \frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$$

39. Ans. c
Explanation:
SI for 5 years = 1020 – 720
= 300
SI for years = $\frac{300}{5} \times 2$
= Rs.120
Principal = Rs.720 – Rs.120
= Rs.600

40. Ans. c
Explanation:
$A^T=-A$
$|A^T|=|-A|$
$|A|=-|A|$
$|A|+|A|=0$
$2|A|=0$
$|A|=0$

41. Ans. b

42. Ans. c

43. Ans. c

44. Ans. a

45. Ans. d

46. Ans. b

47. Ans. c

48. Ans. d

49. Ans. a

50. Ans. a

51. Ans. c

52. Ans. c

53. Ans. a

54. Ans. c

55. Ans. d

56. Ans. d

57. Ans. d

58. Ans. b

59. Ans. c

60. Ans. a

61. Ans. d
Explanation:
In tabulation 'Caption' is the upper part of the table that describes the column and sub-column.

62. Ans. c
Explanation:
Bar diagrams are one dimensional diagrams.

63. Ans. b

Combined H.M. = $$\left(\frac{n_1+n_2}{\frac{n_1}{H_1}+\frac{n_2}{H_2}}\right)=\frac{2+3}{\frac{2}{\left(\frac{2}{5}\right)}+\frac{3}{\left(\frac{1}{5}\right)}}$$

$$= \frac{5}{5+15}$$

$$= \frac{5}{20} = \frac{1}{4}$$

64. Ans. d

Explanation : $\overline{x} = 3, MD_x = 0.3$

$2\overline{x} + 3\overline{y} - 7 = 0$

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

MD of y = $\left|\frac{2}{3}\right|$ MD of X = $\frac{1}{5}$

co-efficient of mean deviation of y about mean =

$= \frac{\text{M.D of Y}}{\overline{y}} \text{x } 100 = 60$

65. Ans. b

Explanation:

Given x takes $x_1, x_2, \ldots\ldots\ldots x_{10}, -x_1, -x_2, \ldots\ldots\ldots -x_{10}$

$\therefore \sum_{i=1}^{20} x_i = 0$

and given $\sum_{i=1}^{20} x_i^2 = 40$

$\therefore$ S.D. of x = $\sqrt{\frac{\sum_{i=1}^{20} x_i^2}{n} - \left(\frac{\sum_{i=1}^{20} x_i}{n}\right)^2}$

$= \sqrt{\frac{40}{20} - \left(\frac{0}{20}\right)^2} = \sqrt{2}$

66. Ans. b

Explanation:

G.M. = $(2 \text{ x } 2^2 \text{x } 2^3 \text{x } 2^4 \text{x} 2^5 \text{x} 2^6)^{1/6}$

$=2^{7/2}$

67. Ans. d

Explanation:

$P(A/B) = \frac{P(A \cap B)}{P(B)} = \frac{1}{2}$

The following table gives distribution of wages of 100 workers:

Wages (Rs.)	120-140	140-160	160-180	180-200	200-220	220-240	240-260
No. of Workers	9	20	0	10	8	35	18

The probability that his wages are under Rs. 140 is :

(a) 20/100

(b) 9/100

(c) 29/100

(d) None

68. Ans. b
Explanation:
The probability that his wages are under Rs. 140 = 9/100.

69. Ans. d

70. Ans. a
Explanation:

$$\text{Income in 2010} = \text{Income in 2005} \times \frac{\text{CPI in 2010}}{\text{CPI in 2005}}$$

$$= 25000 \times \frac{220}{160} = 34375\,\text{Rs.}$$

So Dearness allowance = 34375-25000 = 9375

71. Ans. a
Explanation:
$Q_1 = m - 0.675\ s = 13.25$
MD = 0.8 s = 8
s = 10
m = 20
mode = 20

72. Ans. a
Explanation :

Commodity	A	B	C	D	E	F
Group Index (R)	120	132	98	115	108	98
Weight (W)	6	3	4	2	1	4
(RW)	720	396	392	230	108	392

General Index = $\frac{\sum RW}{\sum W} = \frac{2238}{20} = 111.90$

73. Ans. b
Explanation:

$$5x + 2y = 6$$

$$2y = 6 - 5x$$

$$y = \frac{6}{2} - \frac{5x}{2}$$

$$|b| = \left|\frac{-5}{2}\right| = \frac{5}{2}$$

[coefficient of x]

mean deviation of y = |b| × mean deviation of x about mean.

$$= \frac{5}{2} \times 6 = 15$$

74. Ans. b
Explanation : If two variables are uncorrelated (i.e. r = 0) then regression lines are perpendicular.

75. Ans. b

Explanation : $r = \frac{Cov\,(x,y)}{SD_x . SD_y}$

$0.28 = \frac{7.6}{3 \text{ x } SD_y}$

$SD_y = 9.048$

76. Ans. a

77. Ans. b

Explanation:

Standard deviation is affected by change of scale so variance is 25 X 9 = 225.

78. Ans. c

Explanation:

$$P_{2000,\,2003} = \frac{P_{2003} \times 100}{P_{2000}}$$

$$= \frac{60 \times 100}{15} = 400\%$$

79. Ans. c

80. Ans. c

Explanation:

$$X = \frac{LCL + UCL}{2} = \frac{L + UCL}{2} = M$$

UCL = 2m – L

81. Ans. b

Explanation:

Cov (X, Y)

$$= \frac{1}{n}\left\{\sum_{i=1}^{n} x_i y_i - \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)\left(\sum_{i=1}^{n} y_i\right)\right\}$$

$$= (1/5)(110 - (1/5) \times 15 \times 36)$$

$$= (1/5)(110 - 108) = (2/5) = 0.4$$

82. Ans. a

Explanation:

x	300	–80
p	0.57	0.43

Expected value = 300×0.57–80×0.43 = 136.6

83. Ans. d

84. Ans. d

85. Ans. b

Explanation:
Chain index number for

1993 : $\frac{103\times100}{100}=103$

1994 : $\frac{103\times105}{100}=108.15$

1995 : $\frac{108.15\times112}{100}=121.13$

1996 : $\frac{121.13\times108}{100}=130.82$

86. Ans. a
Explanation:
Let n positive observations are
$x_1, x_2, x_3, - - -, x_n$

$\therefore \quad HM=\left(\frac{n}{\frac{1}{x_1}+\frac{1}{x_2}+---+\frac{1}{x_n}}\right)=h$ (given)

since each observation is repeated once more time.
$\therefore$ n will become $\rightarrow$ 2n

Hence new HM = $\frac{2n}{\left(\frac{1}{x_1}+\frac{1}{x_1}\right)+\left(\frac{1}{x_2}+\frac{1}{x_2}\right)+...+\left(\frac{1}{x_n}+\frac{1}{x_n}\right)}$

$= \frac{2n}{2\left(\frac{1}{x_1}+\frac{1}{x_2}+---+\frac{1}{x_n}\right)}$

= h

87. Ans. c

88. Ans. b
Explanation : $\bar{x}=1500,\ SD=400$
After 1st year
Mean = 1500 + 20% of 1500=1800
SD = 400 + 20% of 400 = 480

After 2nd year
Mean = 1800 + 100 = 1900
SD = 480 (no change)

89. Ans. a

90. Ans. b

91. Ans. b
Explanation:

$$\frac{\sigma_x}{\sigma_y} = \sqrt{\frac{b_{xy}}{b_{yx}}}$$

$$= \sqrt{\frac{8}{15}}$$

$$= 0.73$$

92. Ans. b
Explanation :

$$\frac{L}{P} = \frac{\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0}}{\frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}} = \frac{\frac{20+5x}{15}}{\frac{10+2x}{7}} = \frac{28}{27}$$

$$= \frac{140+35x}{150+30x} = \frac{28}{27}$$

$$x = 4$$

93. Ans. c

94. Ans. b
Explanation : Chain index for any year

$$= \frac{\text{Link relative (index) of current year} \times \text{Chain index of the previous year}}{100}$$

95. Ans. c
Explanation:

Commodity	R	W	RW
I	110	3	330
II	120	3	360
III	70	1	70
Total		7	760

Weighted Price Index = $\frac{\Sigma RW}{\Sigma W} = \frac{760}{7} = 108.5$

96. Ans. b

97. Ans. a
Explanation:

The regression line : $y - \bar{y} = b_{yx}\ x - \bar{x}$

or $y-8.8=1.24(x-5.5)$

$\Rightarrow y=1.24x+1.98$

98. Ans. b

Explanation:

The two lines of regression are

$2x-7y+6=0$ ….(1)

and $7x-2y+1=0$ ….(2)

If we take (1) as the regression equation of Y on X, then (2) is that of X on Y. We can write these as :

$y=\frac{2}{7}x+\frac{6}{7}$ and $x=\frac{2}{7}y-\frac{1}{7}$

respectively.

$\therefore b_{yx}=\frac{2}{7}$ and $b_{xy}=\frac{2}{7}$

$\Rightarrow b_{yx}b_{xy}=\frac{2}{7}\times\frac{2}{7}=\frac{4}{49}<1$

So, our choice is valid.

Now, $r^2=b_{yx}b_{xy}=\frac{4}{49}\Rightarrow r=\frac{2}{7}$

(Note that $b_{yx}>0$), so r > 0

99. Ans. c

Explanation:

Sum of deviation from mean for any set of observation is Zero.

100. Ans. a

Explanation:

For two positive numbers SD is always Half of range.

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