MP TET Varg 2 Secondary Teacher Maths

Q1. What is the mean deviation about the mean for the data 4, 7, 8, 9, 10, 12, 13, 17 ?
(a) 2.5
(b) 3
(c) 3.5
(d) 4

Q2. The variance of 20 observations is 5. If each observation is multiplied by 2, then what is the new variance of the resulting observations?
(a) 5
(b) 10
(c) 20
(d) 40

Q3. If the numbers n – 3, 4n – 2, 5n + 1 are in AP, what is the value of n?
(a) 1
(b) 2
(c) 3
(d) 4

Q4. A man walks 10 m towards a lamp post and notices that the angle of elevation of the top of the post increases from 30° to 45°. The height of the lamp post is
(a) 10 m
(b) $(5\sqrt{3}+5)$ m
(c) $(5\sqrt{3}-5)$ m
(d) $(10\sqrt{3}+10)$ m

Q5. The market price of an article is Rs. 550. A shopkeeper allows a discount of 20% and still gets a profit of 10%. If he sells it for Rs. 470, his profit percent will be:
(a) 16.8
(b) 18
(c) 17.5
(d) 16

Q6. The value of $6-6\div6\times6+(6\div6\text{ of }6)\times6-\left(3\frac{2}{3}\div\frac{11}{30}\text{ of}\frac{2}{3}\right)\div5$ is:
(a) 0
(b) 2
(c) -1
(d) -2

Q7. On selling an article for Rs. 462, a shopkeeper losses 40%. At what price he should sell the article in order to earn a profit of 20%?
(a) 924
(b) 854
(c) 946
(d) 840

Q8. The function $f(x) = x^2 - 4x, x \in [0, 4]$ attains minimum value at
(a) x = 0
(b) x = 1
(c) x = 2
(d) x = 4

Q9. What is $\int_{-\frac{\pi}{6}}^{\frac{\pi}{6}} \frac{\sin^5 x \cos^8 x}{x^4} dx$ equal to?
(a) π/2
(b) π/4
(c) π/8
(d) 0

Q10. The differential equation of the curve y = sin x is
(a) $\frac{d^2y}{dx^2} + y\frac{dy}{dx} + x = 0$
(b) $\frac{d^2y}{dx^2} + y = 0$
(c) $\frac{d^2y}{dx^2} - y = 0$
(d) $\frac{d^2y}{dx^2} + x = 0$

Q11. What is the degree of the differential equation
$\left(\frac{d^4y}{dx^4}\right)^{\frac{3}{5}} - 5\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 5 = 0$?
(a) 5
(b) 4
(c) 3
(d) 2

Q12. If $|\vec{a}| = \sqrt{2}, |\vec{b}| = \sqrt{3}$ *and* $|\vec{a} + \vec{b}| = \sqrt{6}$, *then what is* $|\vec{a} - \vec{b}|$ equal to?
(a) 1
(b) 2
(c) 3
(d) 4

Q13. In how many ways can the letters of the word 'GLOOMY' be arranged so that the two O's should not be together?
(a) 240
(b) 480
(c) 600
(d) 720

Q14. A bag contains 5 black and 3 white balls. Two balls are drawn at random one after the other without replacement. What is the probability that both are white?
(a) 1/28
(b) 1/14
(c) 3/28
(d) None of the above

Q15. If a and b are rational and b is not perfect square, then the quadratic equation with rational coefficients whose one root is 3a+√b is
(a) $x^2 - 6ax + 9a^2 - b = 0$
(b) $3ax^2 + x - \sqrt{b} = 0$
(c) $x^2 + 3ax + \sqrt{b} = 0$
(d) $\sqrt{b}\,x^2 + x - 3a = 0$

Q16. If A is a finite set having n elements, then the number of relations which can be defined in A is
(a) 2^n
(b) n^2
(c) 2^{n^2}
(d) n^n

Q17. What is $0.9 + 0.09 + 0.009 + \ldots$ Equal to?
(a) 1
(b) 1.01
(c) 1.001
(d) 1.1

Q18. In a group of 50 people, two tests were conducted, one for diabetes and one for blood pressure. 30 people were diagnosed with diabetes and 40 people were diagnosed with high blood pressure. What is the minimum number of people who were having diabetes and high blood pressure?
(a) 0
(b) 10
(c) 20
(d) 30

Q19. If C (28, 2r) = C(28, 2r –4), then what is r equal to?
(a) 7
(b) 8
(c) 12
(d) 16

Q20. Q134. If the 8-digit number 179x091y is divisible by 88, the value of (5x–8y) is:
(a) 4
(b) 7
(c) 9
(d) 5
Q135.

Q21. What is $\frac{\cot 54°}{\tan 36°} + \frac{\tan 20°}{\cot 70°}$ *equal to?*
(a) 0
(b) 1
(c) 2
(d) 3

Q22. If $\left(x + \frac{1}{x} + 1\right)\left(x + \frac{1}{x} - 1\right) = 2, then\ x^{32} + \frac{1}{x^{32}} = ?$
(a) 1
(b) -1
(c) $\sqrt{3}$
(d) $-\sqrt{3}$

Q23. If α, β are the roots of the equation $ax^2 + bx + b = 0$, then what is the value of $\sqrt{\frac{\alpha}{\beta}} + \sqrt{\frac{\beta}{\alpha}} + \sqrt{\frac{b}{a}}$?
(a) –1
(b) 0
(c) 1
(d) 2

Q24. What is $\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right)$ equal to?
(a) π/2
(b) π/3
(c) π/4
(d) π/6

Q25. What is the equation of the line which passes through (4, –5) and is perpendicular to 3x + 4y + 5 = 0?
(a) 4x – 3y – 31 = 0
(b) 3x – 4y – 41 = 0
(c) 4x + 3y – 1 = 0
(d) 3x + 4y + 8 = 0

Q26. Find the largest number among $2^{65}, 3^{52}, 5^{39}, 7^{26}$
(a) 2^{65}
(b) 3^{52}
(c) 5^{39}
(d) 7^{26}

Q27. The centroid of the triangle with vertices (2, 3), (–2, –5) and (3, 5) is at
(a) (1, 1)
(b) (2, –1)
(c) (1, –1)
(d) (1, 2)

Q28. What is the derivative of x^3 with respect to x^2 ?
(a) $3x^2$
(b) $\frac{3x}{2}$
(c) x
(d) $\frac{3}{2}$

Q29. If $f(x) = 2x^2 + 3x - 5$, then what is $f'(0) + 3f'(-1)$ equal to?
(a) –1
(b) 0
(c) 1
(d) 2

Q30. What is $\int (x \cos x + \sin x)dx$ equal to?
Where c is an arbitrary constant.
(a) x sin x + c
(b) x cos x + c
(c) –x sin x + c
(d) –x cos x + c

Solutions

S1. Ans.(b)

Sol.

$\text{Mean} = (\overline{x}) = \frac{\sum xi}{N}$

$\text{Here } \overline{x} = \frac{4+7+8+9+10+12+13+17}{8} = 10$

$\therefore \text{ Mean deviation about mean} = \frac{\Sigma|xi-\overline{x}|}{N}$

$= \frac{|4-10|+|7-10|+|8-10|+|9-10|+|10-10|+|12-10|+|13-10|+|17-10|}{8}$

$= \frac{6+3+2+1+0+2+3+7}{8} = \frac{24}{8} = 3$

S2. Ans.(c)

Sol.

Let $x_1, x_2, \ldots, x_{20}$ be the given observations.

Given, $\frac{1}{20}\sum_{i=1}^{20}(x_i - \overline{x})^2 = 5$

To find variance of $2x_1, 2x_2, 2x_3, \ldots, 2x_{20}$,

Let $\overline{x}$ denotes the mean of new observation,

Clearly, $\overline{x} = \frac{\sum_{i=1}^{20} 2x_i}{20} = \frac{2\sum_{i=1}^{20} x_i}{20} = 2\overline{x}$

Now, variance of new observation

$= \frac{1}{20}\sum_{i=1}^{20}(2x_i - \overline{x})^2 = \frac{1}{20}\sum_{i=1}^{20}(2x_i - 2\overline{x})^2$

$= \frac{1}{20}\sum_{i=1}^{20} 4(x_i - \overline{x})^2 = 4\left(\frac{1}{20}\sum_{i=1}^{20}(x_i - \overline{x})^2\right) = 4 \times 5 = 20$

S3. Ans.(a)

Sol.

Given n−3, 4n − 2, 5n + 1 are in A. P.

∴ 2(4n − 2) = n − 3 + 5n + 1

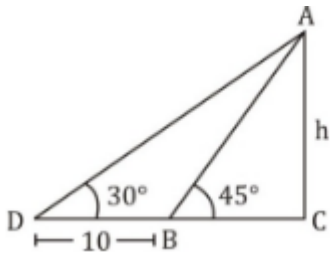
8n − 4 = 6n − 2

2n = 2.

n = 1

S4. Ans.(b)

Sol.



Let AC = h

In Δ A C B.

Tan 45° = $\frac{AC}{BC}$

⇒ BC = AC = h

In Δ A C D

Tan 30° = $\frac{h}{10+h}$

⇒ 10 + h = $\sqrt{3}\,h$

⇒ 10 = $(\sqrt{3}-1)h$

⇒ $\frac{10}{(\sqrt{3}-1)} = h$

= $\frac{10(\sqrt{3}+1)}{2} = h$

= $5\sqrt{3}+5 = h$

S5. Ans.(c)

Sol. CP = MP

100 – D = 100 + P

⇒ 80 = 110

⇒ 8 = 11

11 units = 550

1 unit = 50

CP = 8 units ⇒ 8 × 50

= 400

Now Profit% = $\frac{70}{400}$ × 100% = 17.5%

S6. Ans.(d)

Sol.

$6 - 6 \div 6 \times 6 + (6 \div 6 \text{ of } 6) \times 6 - \left(\frac{11}{3} \div \frac{22}{90}\right) \times \frac{1}{5}$

$\Rightarrow 6 - 1 \times 6 + \left(\frac{1}{6}\right) \times 6 - (15) \times \frac{1}{5}$

⇒ 0 + 1 – 3 = –2

S7. Ans.(a)

Sol. 40% Loss =2/5

20% =1/5

40% Loss at selling 462 Rs.

CP	SP
5	3 → 462 ⇒ 1 → 154

⇒ CP = 5 × 154 = 770 Rs.

Now S.P at 20% profit

= $\frac{770\times120}{100} = 924$

New S.P = 924 Rs.

S8. Ans.(c)

Sol.

$f(x) = x^2 - 4x$

$f'(x) = 2x - 4$

Put f '(x) = 0

$\Rightarrow 0 = 2x - 4$

$\Rightarrow x = 2$

f "(x) = 2 > 0.

Hence f(x) attains minimum value at x = 2.

S9. Ans.(d)

Sol.

$$f(x) = \frac{\sin^5 x \cos^3 x}{x^4}$$

$$f(-x) = \frac{(\sin(-x))^5(\cos(-x))^3}{(-x)^4}$$

$$= \frac{(-\sin x)^5(\cos x)^3}{x^4}$$

$$= \frac{-\sin^5 x \cos^3 x}{x^4}$$

$\Rightarrow$ f(x) is an odd function.

Hence, $\int_{-\pi/6}^{\pi/6} \frac{\sin^5 x \cos^3 x}{x^4} dx$

= 0.

S10. Ans.(b)

Sol.

y = sin x _____(1)

$\frac{dy}{dx} = \cos x$

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

$\frac{d^2y}{dx^2} = -y \qquad [from\ (1)]$

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

S11. Ans.(c)

Sol.

$$\left(\frac{d^4y}{dx^4}\right)^{\frac{3}{5}} - 5\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 5 = 0$$

$$\left(\frac{d^4y}{dx^4}\right)^3 = \left[5\frac{d^3y}{dx^3} - 6\frac{d^2y}{dx^2} + 8\frac{dy}{dx} - 5\right]^5$$

$\therefore$ Required degree = 3

S12. Ans.(b)

Sol.

Given, $|\vec{a}+\vec{b}| = \sqrt{6}$.

Squaring both sides.

$|a|^2 + |b|^2 + 2(a.b) = 6$

$2 + 3 + 2\,(a.b) = 6$

$2(a.b) = 1$ _____(1)

Consider

$|\vec{a}-\vec{b}|^2$

$= |a|^2 + |b|^2 - 2(a.b)$

$= 2 + 3 - 1$

$= 4$

$\Rightarrow |\vec{a}-\vec{b}| = 2.$

S13. Ans.(a)

Sol.

First we arrange the four letters G, L, M and Y in the alternate position = 4!

Now, rest of letters O, O arrange in 5 alternate positions = ${}^5C_2$

∴ Required number of ways = 4! × ${}^5c_2$

$= 4 \times 3 \times 2 \times \frac{5!}{3! \times 2!}$

$= 4 \times 3 \times 2 \times \frac{5 \times 4}{2}$

$= 24 \times 10 = 240$

S14. Ans.(c)

Sol.

Required Probability $= \frac{3}{8} \times \frac{2}{7} = \frac{3}{28}$

S15. Ans.(a)

Sol.

Since b is not a perfect square, therefore other root will be $3a - \sqrt{b}$

Required quadratic equation is

$x^2 - [(3a+\sqrt{b}) + (3a-\sqrt{b})]x + (3a+\sqrt{b})(3a-\sqrt{b}) = 0$

$\Rightarrow x^2 - 6ax + 9a^2 - b = 0$

S16. Ans.(c)

Sol.

If A is a finite set having n elements, then the number of relations which can be defined in A set is $2^{n \times n} = 2^{n^2}$.

S17. Ans.(a)

Sol.

$S = 0.9 + 0.09 + 0.009 + ...$

$= 9(0.1 + 0.01 + 0.001 + ...)$

$= 9\left[\frac{0.1}{1-0.1}\right] = 9 \times \frac{0.1}{0.9} = 1$

S18. Ans.(c)

Sol.

$n(T) = 50$

$n(D) = 30$

$n(H) = 40$

$n(T) = n(D) + n(H) - n(D \cap H)$

$50 = 30 + 40 - n(D \cap H)$

$n(D \cap H) = 70 - 50 = 20$

Number of people having diabetes and high blood pressure = 20

S19. Ans.(b)

Sol.

$C(28, 2r) = C(28, 2r-4)$

${}^{28}C_{2r} = {}^{28}C_{2r-4}$

$\Rightarrow 2r + 2r - 4 = 28$

$\Rightarrow 4r = 32$

$\Rightarrow r = 8$

S20. Ans.(a)

Sol. Divisibility by 8

Last 3 digits must be divisible by 8.

i.e. 91y is divisible by 8 so y=2

Divisibility by 11, difference of the sum of alternate digits must be 0 or 11

So, x = 4

Now, (5x-8y) = 20-16=4

S21. Ans.(c)

Sol.

$$\frac{\cot 54^\circ}{\tan 36^\circ} + \frac{\tan 20^\circ}{\cot 70^\circ} = \frac{\cot(90^\circ - 36^\circ)}{\tan 36^\circ} + \frac{\tan(90^\circ - 70^\circ)}{\cot 70^\circ}$$

$$= \frac{\tan 36^\circ}{\tan 36^\circ} + \frac{\cot 70^\circ}{\cot 70^\circ} = 1 + 1 = 2$$

S22. Ans.(b)

Sol.

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

$x + \frac{1}{x} = \sqrt{3}$

$x^6 = -1$

$x^{32} + \frac{1}{x^{32}}$

$= x^{6\times5+2} + \frac{1}{x^{6\times5+2}} = -x^2 - \frac{1}{x^2}$

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

S23. Ans.(b)

Sol.

α and β are the roots of the given equation, then

$\alpha + \beta = -\frac{b}{a}$ and $\alpha\beta = \frac{b}{a}$

$\sqrt{\frac{\alpha}{\beta}} + \sqrt{\frac{\beta}{\alpha}} + \sqrt{\frac{b}{a}}$

$= \frac{\alpha+\beta}{\sqrt{\alpha\beta}} + \sqrt{\alpha\beta}$

$= \frac{\alpha+\beta+\alpha\beta}{\sqrt{\alpha\beta}} = \frac{-\frac{b}{a}+\frac{b}{a}}{\sqrt{\frac{b}{a}}} = 0$

S24. Ans.(c)

Sol.

$\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right) = \tan^{-1}\left(\frac{\frac{1}{2}+\frac{1}{3}}{1-\frac{1}{2}\times\frac{1}{3}}\right)$

$= \tan^{-1}\left(\frac{\frac{5}{6}}{\frac{5}{6}}\right) = \tan^{-1}(1) = \frac{\pi}{4}$

S25. Ans.(a)

Sol.

$3x + 4y + 5 = 0$ or $y = \frac{-3}{4}x + \frac{-5}{4}$

Slope $= \frac{-3}{4}$

Slope of required line, m $= \frac{-1}{-\frac{3}{4}} = \frac{4}{3}$

Also line passes through $(4, -5)$

Equation of line, $y + 5 = \frac{4}{3}(x - 4)$

$\Rightarrow 3y + 15 = 4x - 16$

$\Rightarrow 4x - 3y - 31 = 0$

S26. Ans.(c)
Sol.

$2^{5\times13}, 3^{4\times13}, 5^{3\times13}, 7^{2\times13}$
$= 32, 81, 125, 49$ (powers are same)
Hence, 5^{39} is the largest number.

S27. Ans.(a)
Sol.

Centroid $= \left(\frac{2-2+3}{3}, \frac{3-5+5}{3}\right)$
$= (1, 1)$

S28. Ans.(b)
Sol.

$U = x^3$
$\frac{dU}{dx} = 3x^2$ .....(1)
$V = x^2$
$\frac{dV}{dx} = 2x$ .....(2)
From (1) and (2)
$\frac{dU}{dV} = \frac{3x^2}{2x} = \frac{3}{2}x$

S29. Ans.(b)
Sol.

$F(x) = 2x^2 + 3x - 5$
$F'(x) = 4x + 3$
$F'(0) + 3F'(-1) = 3 + 3(-4 + 3) = 0$

S30. Ans.(a)
Sol.

$\int (x\cos x + \sin x)\, dx = \int x\cos x\, dx + \int \sin x\, dx$
$= x\sin x - \int \sin x\, dx + \int \sin x\, dx = x\sin x + c$