JUPEB

Mathematics

Past questions

Paper Type: Objective (PT.1-4)

~~NOT FOR SALE~~

JUPEB MATHEMATICS PAST QUESTIONS (PT.4)

SECTION A

MULTIPLE CHOICE QUESTIONS

Time Allowed: 1 Hour

Answer All Questions.

Use the OMR answer sheet provided to answer the questions. Follow the instructions on the OMR sheet.

1. Obtain the equation of normal to the curve $2y = x^2 - 4x + 1$ at the point (1, 2).

A. $2x + y = 1$

B. $2xy = 1$

C. $2x - y = 1$

D. $y - x = 1$

2. Determine the respective values of p and q if $(x - 1)$ and $(x + 2)$ are factors of $2x^3 + px^2 - x + q = 0$

A. $-5, 6$

B. $6, 5$

C. $5, -6$

D. $5, 6$

3. If $f: x \rightarrow x^2 + c$ and $g: x \rightarrow ax + b$, find $(g \circ f)(x)$.

A. $(x^2 + c) + b$

B. $(ax + b)^2 + c$

C. $(x^2 + c)$

D. $(ax + b)^2$

4. If α and β are the roots of the quadratic equation $ax^2 + bx + c = 0$, obtain the equation whose roots are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$

A. $cx^2 + bx + a$

B. $bx^2 + cx + a$

C. $cx^2 + abx + 1$

D. $x^2 + bx + a$

5. Deduce the values of x if $9x^2 = 35x - 2$.

A. $2, \frac{1}{4}$

B. $\frac{1}{2}, 3$

C. $\frac{1}{2}, 4$

D. $\frac{1}{2}, 2$

6. Solve the inequality $2x^2 + 3x - 2 \leq 0$

A. $(2, \frac{1}{2})$

B. $[-2, \frac{1}{2}]$

C. $[2, \frac{1}{2}]$

D. $(-2, \frac{1}{2})$

7. Resolve the expression $\frac{1}{1-x^2}$ into partial fractions.

A. $\frac{\frac{1}{2}}{1-x} + \frac{\frac{1}{2}}{1+x}$

B. $\frac{\frac{1}{2}}{1-x} - \frac{\frac{1}{2}}{1+x}$

C. $\frac{\frac{1}{2}}{1-x} - \frac{1}{1+x}$

D. $\frac{1}{1-x} + \frac{\frac{1}{2}}{1+x}$

8. The sum of the first n terms of a geometric series is 127 and the sum of their reciprocals is $\frac{127}{64}$, if the first term is 1, find n and the common ratio.

A. 5, 2

B. 7, 2

C. 2, 7

D. 5, 7

9. Obtain the points common to the two loci whose equations are $y^2 - 6y - 4x + 1 = 0$ and $2y - x - 11 = 0$

A. (-1, 9), (-1, 7)

B. (7, 9), (-1, 5)

C. (7, -9), (-1, 5)

D. (-5, 9), (-1, 7)

10. Solve for $\tan \theta$ in the equation $7\sec^2\theta = 6\tan\theta + 8$

A. 1, 1/7

B. 1, - 1/7

C. 2, 1/7

D. -2, 1/7

11. What is the coefficient of x^6 in the expansion $\left(\frac{1}{x^2} - x\right)^{18}$?

A. 1020

B. 2020

C. 3060

D. 4020

12. Given that $A = \{x : x < 4, x \text{ is a natural number}\}$ and $B = \{x : x \geq$

2, x *is an integer*}. Deduce $(A \cap B)$ $\times (A \setminus B)$.

A. {(1,2), (1,3)}
B. {(2,3), (2,1)}
C. {(2,1), (3,1)}
D. {(3,2), (1,2)}

13. Evaluate the gradient of the curve $3x^2 + 2xy - y^2 - 8 = 0$ at point A (3, 1).

A. 10
B. -5
C. 8
D. 5

14. An ellipse is a conic section whose eccentricity (e) is

A. e = 1
B. 0 < e < 1
C. e > 1
D. e > 2

15. Find the sum to infinity of the following series $3 + 2 + \frac{4}{3} + \frac{8}{9} + \frac{16}{27} + $ ...

A. 1270
B. 190
C. 18
D. 9

16. If $x = t^2 + 1$ and $y = t^3 + 2$, find y'.

A. $2t$
B. $3t$
C. $\frac{3t}{2}$
D. $\frac{2t}{3}$

17. If $y = (3x + 8)^{19}$, obtain the derivative of y with respect to x.

A. (3x + 8)18
B. 27(3x + 8)
C. 57(3x + 8)^{18}
D. 19(3x + 8)^{18}

18. Evaluate $\int_{-1}^{1} x^2(x^3 + 1)dx$

A. $\frac{2}{3}$
B. $\frac{1}{3}$
C. -2
D. 2

19. If $y = (1 - 4x)^{-2}$, deduce $\frac{dy}{dx}$

A. $8(1 - 4x)^{-3}$

B. $8(1 - 4x)^{-2}$

C. $-8(1 - 4x)^{-2}$

D. $8(1 - 4x)^{-2}$

20. Compute $\lim\limits_{x \to 4} \left\{ \frac{x-4}{\sqrt{x}-2} \right\}$

A. 2

B. -4

C. 4

D. 0

21. Which of the following differential equations is non-linear?

A. $y'' + 4y' - 6y = 0$

B. $y'' + 2xy' - y = 1$

C. $y'' + 2y\frac{dy}{dx} + y^2 = 0$

D. $y''' + 2y'' + x^2y' = x$

22. Solve the differential equation $\frac{dy}{dx} - \frac{x^2}{y} = 0$

A. $3y^2 - x^3 = C$

B. $2y^2 - x^2 + C = 0$

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

D. $2y^3 - 3x^2 = C$

23. An asymptote is a tangent to curve in two points at _____

A. the origin.

B. infinity.

C. the axes.

D. the centre.

24. The following are turning points except _____

A. maximum point.

B. minimum point.

C. inflexion point.

D. maximum and minimum.

25. Solve the differential equation $xdy + ydx = 0$

A. $x - y = C$

B. $xy = C$

C. $\frac{x}{y} = C$

D. $\frac{y}{x} = C$

26. If $y = \frac{1}{x}$ then the nth derivative of y with respect to x equals _____

A. $\frac{(-1)^n n!}{x^{n+1}}$

B. $\frac{(-1)^{n+2} n!}{x^n}$

C. $\frac{(-1)^{n-1} n!}{x^{n+1}}$

D. $\frac{(-1)^n n!}{x^n}$

27. If $y = e^{2x-1}$ find $\frac{d^2 y}{dx^2} - 2\frac{dy}{dx} - 2y$

A. 2

B. 1

C. 0

D. -2

28. Integrate the function xe^x

A. $e^x (x - 1)$

B. $e^x (x + 1)$

C. $xe^x (x + 1)$

D. $x (e^x - 1)$

29. If C is the constant of integration, then which of the following is true for $\int \frac{f'(x)}{f(x)} dx$

A. $\ln[f'(x)]^2 + C$

B. $\ln[f(x)] + C$

C. $\frac{f'(x)}{f(x)} + C$

D. $[f(x)]^2 + C$

30. The motion of a particle along a straight line is specified by the equation $x = 4t^4 - 3t^3$, evaluate the velocity after 3 seconds.

A. $513 ms^{-1}$

B. $378 ms^{-2}$

C. $351 ms^{-1}$

D. $486 ms^{-2}$

31. The motion of a particle along a straight line is specified by the equation $x = 4t^4 - 3t^3$, compute the acceleration after 3 seconds.

A. $513 ms^{-1}$

B. $378 ms^{-2}$

C. $351 ms^{-1}$

D. $486 ms^{-2}$

32. Given that $a = i + j - 2k$, $b = i + k$, $c = 2i - j + 3k$. Evaluate $|2a + b + 2c|$.

A. $\sqrt{85}$

B. $\sqrt{58}$

C. $\pm\sqrt{58}$

D. $-\sqrt{85}$

33. A car accelerates uniformly for 4s and maintains a constant speed for 10s before it finally decelerates uniformly to rest in 6s. If the total distance travelled is 600m, calculate the maximum speed.

A. 40m/s

B. – 40m/s

C. 25m/s

D. 41m/s

34. A body of mass 6kg is suspended at a position P by two light inextensible strings AP and BP which are inclined respectively at angle 20° and 60°, and to the upward vertical. If the system is in equilibrium; calculate the total tension in the string.

A. 62.75N

B. 87.71N

C. 32.75N

D. 25.57N

35. A uniform beam is 14m long and has a mass of 40kg. Masses of 10kg and 20kg are suspended from its end. At what point from 20kg mass must the beam be suspended so that it may rest horizontally on the support.

A. 8m

B. 7m

C. 5m

D. 6m

36. A particle moving along the centre defined by $r = a \cos \omega t \, i + a \sin \omega t \, j$. Determine its speed at any time t.

A. $– a\omega \cos \omega t \, i + a\omega \sin \omega t \, j$
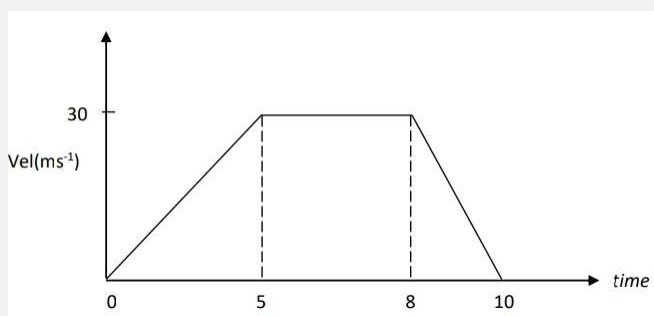
B. $– a\omega$

C. $a\omega$

D. $– \omega 2r$

37. Evaluate $\int_0^2 F(t) \, dt$ if $F(t) = 2e^{-t} + 5 \cos j - 3 \sin t k$.

A. $– 2i + 3k$

B. $2(1-e^{-2})+5\sin 2j+3(1-\cos 2)k$

C. $2e^{-t}i + 5 \sin t \, j + 3 \cos t \, k$

D. $-2i + 3j + 3(1 - \cos 2)$

38. Two forces 10N and 6N act in the direction 060º and 330º respectively. Find the x-component of their resultant.

A. $5\sqrt{3} - 3$

B. $3 - 5\sqrt{3}$

C. $5 - 3\sqrt{3}$

D. $3\sqrt{3} - 5$

39.

The diagram above is a velocity-time graph of moving object. Calculate the distance travelled when the acceleration is zero.

A. 120m

B. 90m

C. 150m

D. 240m

40. Negative Correlation means _____

A. Linear dependence

B. Direct relationship

C. Inverse relationship

D. No relationship

41. How many *5-letter code-words* can be formed from the letters of the word, ALGEBRA, if the *code-word* must begin with *A* and end with *A*?

A. 20

B. 120

C. 60

D. 40

42. In how many ways can a committee of *5* be formed from a group of *8* people consisting of *3* boys, *3* girls and a brother-sister pair; if the committee must include the brother-sister pair?

A. 40

B. 20

C. 56

D. 36

43. Find the probability of at least *4* heads in *6* tosses of a fair coin.

A. $\frac{11}{32}$

B. $\frac{10}{21}$

C. $\frac{1}{6}$

D. ½

44. On a final examination in Mathematics, the mean was *72* and the standard deviation was *15*. Determine the standard score of students receiving the grade of *60*.

A. -0.5

B. 1

C. -0.8

D. 2.5

45. The mean of the numbers 2, 5, 6, 8, *x*, *y* is 6, and their standard deviation is √5. Compute *x* and *y*.

A. 6, 9

B. 6, 7

C. 5, 9

D. 2, 4

46. Compute the expected number of males and its standard deviation in a random sample of 100 families.

A. 25, 5

B. 50, 25

C. 50, 5

D. 10, 5

47. The hypothesis of primary interest is _____

A. alternative.

B. specified.

C. null.

D. exact.

48. The equation is called _____

A. a correlation equation.

B. a prediction equation.

C. a linear regression equation.

D. a non-linear regression equation.

49. An unbiased six sided die has the score 2 engraved on two sides, the score 4 on three sides and

score 6 on the remaining one side. The die is thrown once. Compute the probability of obtaining: a score of 6 or less.

A. 2/6

B. 1/6

C. 5/6

D. 1.

50. An unbiased six sided die has the score 2 engraved on two sides, the score 4 on three sides and score 6 on the remaining one side. The die is thrown once. Compute the probability of obtaining an odd score.

A. 0

B. 1

C. 2/6

D. 5/6

JUPEB MATHEMATICS PAST QUESTIONS (PT.3)

SECTION A

MULTIPLE CHOICE QUESTIONS

Time Allowed: 1 Hour

Answer All Questions.

1. For what value of k will the equation $y^2 - (k - 2)y + 1 = -2k$ have real equal roots?

A. 0, 12

B. 3, 4

C. 0, 3

D. -3, 4

2. Which of the following is correct?

A. $270° = 2\pi$ radians

B. $360° = 3\pi$ radians

C. $90° = \pi$ radians

D. $720° = 4\pi$ radians

3. Given that A and B are subsets of a universal set U, which of the following is true?

A. $(A \cup B)^c = A^c \cup B^c$

B. $(A \cap B)^c = A^c \cup B^c$

C. $(A \cup B)^c = (A \cup B) \cap (B \cup A)$

D. $(A \cap B)^c = A^c \cap B^c$

4. Express the complex number $2+3i$ in polar form.

A. $3.6(\cos 28.1° + i\sin 28.1°)$

B. $3.6(\cos 56.3° + i\sin 56.3°)$

C. $4.8(\cos 36.2° + i\sin 36.2°)$

D. $4.8(\cos 56.3° + i\sin 56.3°)$

5. Let $f : x \to \dfrac{x+1}{x-1}$ be a function defined on the set of real numbers excluding 2. Determine the inverse of the function.

A. $\dfrac{2x-1}{x-1}$

B. $\dfrac{2x+1}{x-2}$

C. $\dfrac{2x+1}{x-1}$

D. $\dfrac{x-1}{2x+1}$

6. Obtain the range of values for which $|2x - 3| < 5$

A. $-1 < x < 4$

B. $1 < x < -4$

C. $-4 < x < 1$

D. $1 > x > 4$

7. Find the constant term in the binomial expansion of $\left(2x + \frac{1}{x}\right)^8$

A. 820

B. 1120

C. 1210

D. 4220

8. The end coordinates of the diameter of a circle are (3, 2) and (9, 6). Formulate the equation for the circle.

A. $x^2 + y^2 - 6x - 4y + 39 = 0$

B. $x^2 + y^2 + 6x + 4y + 36 = 0$

C. $x^2 + y^2 - 12x - 8y + 39 = 0$

D. $x^2 + y^2 - 12x - 8y - 39 = 0$

9. Simplify $\log_7 8 \times \log_6 7 \div \log_6 5 \times \log_8 5$

A. $\log_{10} 1680$

B. 1

C. $\log_{48} 56$

D. 2

10. Obtain the equation of a straight line joining points (-2, 3) and (1, 4).

A. $3y - 11x - 1 = 0$

B. $5y - 3x - 4 = 0$

C. $3y - 2x + 11 = 0$

D. $3y - x - 11 = 0$

11. Derive the solution of the equation: $Cot\ \theta + \tan\theta = 2Cosec\ \theta$

A. $\frac{\pi}{2}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{5}$

12. Formulate a polynomial whose quotient and remainder when divided by x + 1 are $x^2 + 3x - 2$ and -3 respectively.

A. $x^3 - x^2 + 3x - 6$

B. $2x^3 + 3x^2 - x + 4$

C. $x^3 + 4x^2 + x - 5$

D. $x^3 - x^2 + 3x - 6$

13. Two matrices are defined as: A

$$= \begin{bmatrix} 6 & y & 2 \\ -4 & -2 & -6 \\ 10 & 8 & 2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 3 & -2 & 5 \\ 2 & -1 & 2x \\ 1 & -3 & 1 \end{bmatrix}$$

If $A^T = 2B$, evaluate $(2x + y)$.

A. 12

B. 10

C. 8

D. 6

14. A binary operation $\otimes$ is defined on the set $\mathbb{R}$ of real numbers such that for $x \neq 0, y \neq 0 \in \mathbb{R}$

$$x \otimes y = \frac{3x^3 + 4y}{5xy}$$

Evaluate $(1 \otimes 3)$

A. -1

B. $-\frac{3}{5}$

C. $-\frac{2}{3}$

D. 1

15. If $\lim_{x \to c} f(x) = l$ and $\lim_{x \to c} f(x) = m$,

then _____

A. $l < m$

B. $l > m$

C. $l = m$

D. $l \leq m$

16. Write the order and degree of the differential equation $\frac{d^2y}{dx^2} + a^2x = 0$

A. 2, 2

B. 1, 2

C. 3, 2

D. 2, 1

17. If $f(x) = 3^{x-1}$, find $f(x+3) - f(x)$ in terms of $f(x)$.

A. $\frac{15}{2}f(x)$

B. $\frac{13}{2}f(x)$

C. 80 $f(x)$

D. 27 $f(x)$

18. Express $\frac{d^2y}{dx^2}$ in terms of y alone in the equation $x^2 + y^2 = r^2$, where = constant.

A. $\frac{y^2 - r^2}{y^3} - \frac{1}{y}$

B. $-\frac{y^3}{r^2}$

C. $\frac{r^2}{y^3}$

D. $\frac{y^3}{r^2}$

19. Determine $\frac{dy}{dx}$ where $x = a(1+\sin\theta)$ and $y = a(1-\cos\theta)$.

A. $\sin\theta + \cos\theta$

B. $\tan\theta$

C. $\sec^2\theta$

D. $\tan\frac{\theta}{2}$

20. Determine the value of the integral $\int_{-2}^{-1} \frac{dx}{x}$

A. $\log(-2)$

B. $\log\frac{1}{2}$

C. $\log(-1) - \log(-2)$

D. $\log(-1)$

21. Let $f(x) = \begin{Bmatrix} x - 1, when\ x < 1 \\ x^2 + k,\ when\ x \geq 1 \end{Bmatrix}$

Find the value of k for which $f(x)$ is continuous at x=1.

A. 0

B. 1

C. -1

D. 2

22. Find $\frac{dy}{dx}$ if $y = \log_e \sin x$.

A. $-\cot x$

B. $\cot x$

C. $\tan x$

D. $-\tan x$

23. Solve the differentiation equation $\frac{dy}{dx} - xy^3 = 0$

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

B. $\frac{x^2 y^2}{2} = C$

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

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

24. Differentiate $y = e^{2x}\cos x$ using product rule.

A. $e^{-2x}(2\cos x - \sin x)$

B. $e^{2x}(2\cos x - \sin x)$

C. $e^{2x}(2\cos x + \sin x)$

D. $e^{-2x}(2\cos x + \sin x)$

25. Integrate 4^x with respect to x.

A. $\frac{6^x}{\ln 6} + C$

B. $\frac{4^x}{\ln 4} + C$

C. $\frac{5^x}{\ln 5} + C$

D. $\frac{2^x}{\ln 2} + C$

26. Integrate $\frac{\cos x}{1 + sin^2 x}$ with respect to x.

A. tan⁻¹(sin x) + C
B. sin x tan x + C
C. sin⁻¹(tan x) + C
D. tan x − 1 + C

27. Evaluate $\int \frac{3x^2 - 2x + 4}{x^3 - x^2 + 4x - 18} dx$

A. $\ln|x^3 - x^2 + 4x - 8| + C$
B. $\ln|x^3 - x^2 + 4x - 8|$
C. 3ln x³ – 2ln x² + 4ln x – 18x + C
D. $\ln|3x^2 - 2x + 4| + C$

28. Evaluate $\lim_{x \to 0} \frac{e^x - e^{-x}}{x}$

A. 0
B. 4
C. 1
D. 2

29. A vector F is said to be irrotational if _____

A. div(curl F) = 0

B. div F = 0
C. curl(div F) = 0
D. curl F = 0

30. The basic types of friction that exist between two surfaces in contact are _____

A. limiting and static friction
B. limiting and sliding friction
C. sliding and dynamic friction
D. kinetic and dynamic friction

31. A fire fighter 50m away from a burning building directs a stream of water from a fire hose at an angle of 30° above the horizontal. If the velocity of the stream is 40m/s, at what height will the stream of water strike the building? (Take g=9.8m/s²)

A. 20m
B. 18.7m
C. 8.45m
D. 1.0m

32. A 15kg block is pushed up a 35° incline. A friction force of 110N

exist between the block and the incline. What minimum force F, would be necessary to move the block up the incline at a constant speed? (Take g=9.8m/s^2)

A. 26N
B. 84N
C. 150N
D. 194N

33. Find r such that $\bar{u} = 8\hat{\imath} - 2\hat{\jmath} + 2k$ and $\bar{v} = \hat{\imath} + 5\hat{\jmath} + rk$ are orthogonal sectors.

A. ½
B. 1
C. -1
D. -½

34. Find the moment of inertia of a solid sphere 2m in diameter and of mass 5kg about an axis passing through the centre.

A. 2 kgm^2
B. 2 kgm^2
C. 4 kgm^2
D. 5 kgm^2

35. Obtain the momentum of a body with mass 2kg and velocity 5m/s.

A. 9 Ns
B. 8 Ns
C. 10 Ns
D. 11 Ns

36. The force generated from the engine of a car is found to be 300N. Calculate the power developed when the car moves with constants speed of 10m/s.

A. 30 W
B. 300 W
C. 3000 W
D. 30000 W

37. A lift moves with an acceleration of 2m/s^2. Estimate the reaction of the floor on an object of mass 50kg placed on the floor of the lift when it moves up.

A. 600N
B. 300N
C. 200N

D. 100N

38. Given that $\vec{a} = 2i + 3k$, $\vec{b} = 5i - j + k$, $\vec{c} = i + j$, evaluate $(\vec{a}.\vec{b})\,\vec{c}$.

A. $13i - 13j$

B. $13i + 13j$

C. $13i + j$

D. $i + 13j$

39. A body starts from a rest and moves with uniform acceleration to attain a velocity of 15m/s in 10 seconds. Evaluate its acceleration at that time.

A. 1.5 m/s²

B. 1.6 m/s²

C. 1.1 m/s²

D. 0.5 m/s²

40. Data representation in which the bars are joined together is called _____

A. pictogram

B. bictogram

C. histogram

D. bar chart

41. If ${}^{5}C_r = 10$, what is the value of r?

A. 5

B. 4

C. 3

D. 2

42. A problem of Statistics is given to three students A, B, and C whose chances of solving it are $\frac{1}{2}, \frac{3}{4}$ and $\frac{1}{4}$ respectively. Determine the probability that the problem will be solved.

A. $\frac{3}{32}$

B. $\frac{23}{32}$

C. $\frac{15}{32}$

D. $\frac{29}{32}$

43. Given that $Y = aX + b$ where X is a random variable and a and b are constants, then $E(Y)$ and $Var(Y)$ are _____

A. $aE(X) + b, a^2 Var(X)$

B. $aE(X), aVar(X)$

C. $aE(X) + bE(X), a^2 Var(X) + bVar(X)$

D. $E(X), Var(X)$

44. If the probability that an individual suffers a bad reaction from a certain injection is 0.001, determine the probability that out of 2000 individuals, exactly 3 will suffer a bad reaction.

A. 0.12

B. 0.18

C. 0.16

D. 0.08

45. Find the expected number of students admitted to study medicine and surgery in the random sample of 100 students, if the probability of securing admission is 0.2.

A. 20

B. 30

C. 40

D. 50

46. On a final examination in mathematics, the mean was 72, and the standard deviation was 15.

Determine the standard scores of students receiving grade 60.

A. -0.8

B. 1.4

C. 0

D. -0.6

47. Which of the following is NOT a simple probability sampling technique?

A. Systematic

B. Stratified

C. Cluster

D. Quota

48. Obtain a linear regression equation of Y on X using the following information: n=5, $\Sigma x=25$, $\Sigma x^2=165$, $\Sigma y=24$, $\Sigma y^2=124$ and $\Sigma xy=144$

A. $0.8 + 0.6X$

B. $1.8 + 0.6X$

C. $2.6 + 0.6X$

D. $3.8 + 0.6X$

49. The following data regarding the heights (y) and the weights (x) of 5 college students are given: $\Sigma x=15$, $\Sigma y=10$, $\Sigma xy=165$, $\Sigma x^2=325$ and $\Sigma y^2=125$. Evaluate the correlation coefficient between the height and the weight.

A. -0.005
B. 0.005
C. 0.05
D. -0.05

50. The sampling technique that allows the investigator to consciously or unconsciously pass personal judgment to influence the sample selection process is identified as _____

A. stratified random sampling
B. systematic sampling
C. non-probability sampling
D. cluster sampling

SECTION A

MULTIPLE CHOICE QUESTIONS

Time Allowed: 1 Hour

Answer All Questions.

1. Let Q, N, Z, C and Q' denote the set of Rational, Natural, Integer, Complex, and Irrational numbers respectively. Which of the following set contains the whole set of real numbers?

A. $N \cup Z$

B. $Z \cup C$

C. $Q \cup Q' \cup \{0\}$

D. $Q \cup C$

2. Determine the solution set of the inequality: $2x^2 - 3x - 2 < 0$

A. $(2, \infty)$

B. $\left(-\infty, -\frac{1}{2}\right)$

C. $\left(-\frac{1}{2}, 2\right)$

D. $\left[-\frac{1}{2}, 2\right]$

3. Evaluate the conjugate of the complex number: $z = \dfrac{1}{-1+i}$

A. $\dfrac{1}{-1-i}$

B. $\dfrac{-1+i}{2}$

C. $-1 - i$

D. $-1 + i$

4. Complete the value of x if
$$\frac{4^{-x} \times 32^{x+1} + 5x}{5} = \frac{16^{2x+1}}{5} + x$$

A. $\dfrac{1}{5}$

B. $\dfrac{2}{5}$

C. $\dfrac{3}{5}$

D. $\dfrac{4}{5}$

5. Find tan 75° in surd form.

A. $\dfrac{(\sqrt{3} - 2)}{2}$

B. $\dfrac{(\sqrt{3} + 2)}{2}$

C. $\dfrac{(2 - \sqrt{3})}{2}$

D. $\dfrac{(\sqrt{2} - 3)}{2}$

6. Given that $\log_{10} 2 = 0.3010$, $\log_{10} 3 = 0.4771$ and $\log_{10} 7 = 0.8451$, compute $\log_{14} 72$.

A. 0.6502

B. 1.6205

C. 3.6105

D. 1.5025

7. If $U_1 = 3$, $U_2 = 4$, and $U_n = a + bn$, compute U_6.

A. 3

B. 4

C. 2

D. 8

8. Let a and β be the roots of the equation: $x^2 + 5x + 6 = 0$. Deduce the equation whose roots are a^2 and β^2

A. $x^2 - 13x + 36 = 0$

B. $x^2 - 5x + 13 = 0$

C. $x^2 + 13x + 36 = 0$

D. $x^2 - 13x - 13 = 0$

9. Which form of partial fraction is equivalent to the algebraic fraction: $\dfrac{f(x)}{(x^2 + 1)(x - b)^2}$

A. $\dfrac{Ax+B}{x^2+a} + \dfrac{Cx+D}{(x-b)^2}$

B. $\dfrac{Ax+B}{x^2+a} + \dfrac{C}{x-b} + \dfrac{D}{(x-b)^2}$

C. $\dfrac{Ax+B}{x^2+a} + \dfrac{Cx+D}{x-b} + \dfrac{Ex+F}{(x-b)^2}$

D. $\dfrac{Ax+B}{x^2+a} + \dfrac{C}{x-D} + \dfrac{D}{(x-b)^2}$

10. Determine the centre of the radius of the circle $x^2 + y^2 - 2ax + 2yb + a^2 = 0$ in terms of a and b.

A. Centre $(-a, -b)$, radius $= b$

B. Centre (a, b), radius $= a$

C. Centre $(a, -b)$, radius $= b$

D. Centre $(-a, b)$, radius $= a$

11. Express $1 + i$ in the conjugate of its polar.

A. $\sqrt{2}(cos45° + isin45°)$

B. $\sqrt{2}(cos315° + isin315°)$

C. $\sqrt{2}(cos315° - isin315°)$

D. $2(cos45° - isin45°)$

12. A binary operation, '∗' is defined on the set of real numbers, R by: $x * y = \frac{1}{5}(5x + 5y - 4)$ for any two real numbers: $x, y \in R$. Calculate the identity element.

A. 5

B. 4

C. $5/4$

D. $4/5$

13. If $P = \begin{bmatrix} y & 3 & 0 \\ 2 & 1 & y \\ 2 & 1 & 2 \end{bmatrix}$, what is the range of values of y for which $|P|=0$?

A. -2 < y < 6

B. 2 < y < 6

C. -6 < y < 2

D. -6 < y < -2

14. Calculate the sum to infinity of
1 + tan 30° + tan² 30° + tan³ 30° + …

A. $\frac{1}{2}(3 + \sqrt{3})$

B. $\frac{1}{2}(2 + \sqrt{3})$

C. $\frac{1}{2}(3 - \sqrt{3})$

D. $\frac{1}{2}(2 - \sqrt{3})$

15. Estimate the value of the product log₂ 3log₃ 4log₄ 5log₅ 6log₆ 7log₇ 8.

A. 1

B. 2

C. 3

D. 4

16. Let the expression $ax^2 + bx + c = 8$ at $x = 1$. If the derivative is $4x + 2$, determine the values of a, b, and c respectively.

A. 2, 4, 2

B. 4, 4, 0

C. 2, 2, 4

D. 4, 2, 2

17. The distance, S in metres moved by a particle in time, t in seconds is given by $S(t)=3.5t^3 - 2t$. Evaluate its speed after 2 seconds.

A. $22ms^{-1}$

B. $40ms^{-1}$

C. $24ms^{-1}$

D. 28ms^{-1}

18. Calculate the gradient of the curve $y = x^3 - 3x^2 + 7x + 23$ at the point (2, 1).

A. 7

B. 38

C. 4

D. 28

19. Find the derivative of the line joining the points $A(3,5)$ to $B(6,-8)$

A. $-\frac{13}{3}$

B. $\frac{13}{3}$

C. 22

D. -22

20. Evaluate $\lim\limits_{x \to n} \left(\frac{x + sinx}{x(x + 1)} \right)$

A. 0

B. -2

C. 2

D. ∞

21. Given that $x=sin(t)$ and $y=cos(t)$, then the letter t is simply called the _____

A. Time

B. Variation

C. Parameter

D. Differential value

22. Given that $y=cos2\theta$, $x=sin\ \theta$. Express $\frac{dy}{dx}$ in terms of θ.

A. -4 sin θ

B. -2 sin2θ

C. 4 cos θ

D. -4 cos θ sin θ

23. Let the given curve of a parabola by $y^2=x$. Estimate the area of the curve in terms of x.

A. $\frac{x}{2} + c$

B. $\frac{2x}{7} + c$

C. $\frac{2x^{3}/_{2}}{3} + c$

D. $2x + c$

24. Find the derivative of the function $y=log_e\ tan\ 2x$.

A. $2\sec^2 2x$

B. $\dfrac{2}{\tan 2x}$

C. $\dfrac{2\sec^2 2x}{\tan 2x}$

D. $\dfrac{\sec^2 2x}{\tan 2x}$

25. The radius of a sphere is increasing at the rate of 0.1cm/s. Determine the rate at which the surface area is increasing when the radius is 5cm.

A. $8\pi cm^2/s$

B. $6\pi cm^2/s$

C. $5\pi cm^2/s$

D. $4\pi cm^2/s$

26. Evaluate y in terms of x if $\dfrac{dy}{dx} = 3x^2 - 6x + 2$, given that $y=7$ when $x=0$.

A. $y = x^3 - 3x^2 + 2x$

B. $y = x^3 - 3x^2 + 5x + 3$

C. $y = x^3 - 3x^2 + 2x + 7$

D. $y = x^3 - 3x^2 + 2x + 5$

27. Obtain $\dfrac{d^2y}{dx^2}$ for the function:

$y=2x^{2/3} - 5x^{1/2}$

A. $\dfrac{-2}{9}x^{-\frac{2}{3}} - \dfrac{5}{4}x^{-\frac{3}{7}}$

B. $\dfrac{-4}{9}x^{-4/3} + \dfrac{5}{4}x^{-3/2}$

C. $\dfrac{-4}{9}x^{-4/9} + \dfrac{5}{4}x^{-3/7}$

D. $\dfrac{-4}{3}x^{-\frac{4}{3}} - \dfrac{1}{4}x^{-\frac{3}{2}}$

28. Evaluate $\int_0^z 12x^2 dx = 1372$ to get the value of z.

A. -14

B. 14

C. 7

D. 8

29. The expression for e^{-x} is given as _____

A. $1 + x + \dfrac{x^2}{2!} + \dfrac{x^3}{3!} + \dfrac{x^4}{4!} + \cdots$

B. $1 - x + \dfrac{x^2}{2!} - \dfrac{x^3}{3!} + \dfrac{x^4}{4!} - \cdots$

C. $1 - x + \dfrac{x^2}{2!} - \dfrac{x^3}{3!} + \dfrac{x^4}{4!} + \cdots$

D. $1 + x + \dfrac{x^2}{2!} + \dfrac{x^3}{3!} + \dfrac{x^4}{4!} - \cdots$

30. Describe the unit vector in the direction of $2\boldsymbol{i} + \boldsymbol{j} - 2\boldsymbol{k}$.

A. $\dfrac{2}{3}\boldsymbol{i} + \dfrac{1}{3}\boldsymbol{j} - \dfrac{2}{3}\boldsymbol{k}$

B. $\dfrac{2}{5}\boldsymbol{i} + \dfrac{1}{5}\boldsymbol{j} - \dfrac{2}{5}\boldsymbol{k}$

C. $\frac{2}{7}i + \frac{1}{7}j - \frac{2}{7}k$

D. $\frac{2}{9}i + \frac{1}{9}j - \frac{2}{9}k$

31. Complete the modulus of the vector $2i + 3j - \sqrt{3}k$

A. 2

B. 3

C. 4

D. 5

32. An object of mass 2.5kg moving at a constant velocity of 12ms⁻¹ comes in contact with a resistance of 10N. How long does it take the body to come to rest?

A. 2s

B. 3s

C. 4s

D. 5s

33. With what velocity should a stone be thrown vertically upward to reach the top of a hill 50m high?
[Take g=10ms⁻²]

A. 10 ms^{-1}

B. 31.62 ms^{-1}

C. 100 ms^{-1}

D. 3.33 ms^{-1}

34. A truck travelling on level ground is subject to a resisting force (from the brakes and air resistance) of 250kN for a distance of 5km. How much kinetic energy does the train lose?

A. 1250 MJ

B. -1250 MJ

C. 1250 J

D. 1250 KJ

35. A body starts from rest and moves with a uniform acceleration of 10ms^{-1}. Calculate the distance it covers in the 4th second.

A. 35 m

B. 80 m

C. 24 m

D. 45 m

36. A stone is dropped from the top of a building and reaches the ground after 2 seconds. Determine the height of the building.

A. 19 m

B. 18 m

C. 20 m

D. 25 m

37. A load of mass 70kg is placed in a lift. Calculate the reaction between the floor of the lift and the load when the lift moves upwards with an acceleration of $2ms^{-2}$.

[Take $g = 9.8ms^{-2}$]

A. 726N

B. 800N

C. 850N

D. 856N

38. A block of mass 3kg rests on a rough horizontal table. If the coefficient of friction between the block and the table is 0.43, determine the minimum horizontal force that will make the block to slide on the table.

[Take $g=10ms^{-2}$]

A. 12.9N

B. 43.0N

C. 30.0N

D. 9.8N

39. Three points A, B, and C have spatial coordinates (-5, -2, 3), (-2, 5, 3) and (4, 5, 2) respectively. Find the scalar product of displacement vectors $\overrightarrow{AB}$ and $\overrightarrow{BC}$

A. -42.0

B. -14.0

C. -18.0

D. -24.0

40. The mean score of 100 students in a class that took a Statistics test is 72. If the mean of the score of 70 boys in the class is 75, calculate the mean score of the girls in the class.

A. 70

B. 65

C. 60

D. 58

41. In how many ways can the first, second, and third positions be

won by six athletes in a race of 100 metres?

A. 20
B. 60
C. 120
D. 100

42. A bag contains 5 white, 2 black and 3 green balls. If 3 balls are drawn at random without replacement, what is the probability that 2 balls are white and 1 ball is black?

A. 1/6
B. 2/5
C. 1/5
D. 9/10

43. When a distribution is moderately skewed with one mode, which of the following relation is correct?

A. Mean – Median =3(Mean-Median)
B. 2Mean = 3Mean – Mode
C. Mean + Mode = 3(Mean-Median)
D. Mean – Mode = 3(Mean-Median)

44. Which of the measures of central tendency is often affected by extreme values?

A. Mode
B. Mean
C. Data
D. Median

45. The height, $x cm$ of a sample of 80 female students are summarized by the equation $\sum(x - 160) = 240$. Compute the mean height of a female student.

A. 243
B. 163
C. 136
D. 83

46. A fair coin is tossed 5 times. Find the probability of obtaining at least 4 heads.

A. $\frac{5}{16}$
B. $\frac{1}{16}$
C. $\frac{3}{16}$
D. $\frac{13}{16}$

47. Deduce the mode of 6, 8, 2, 1, 1, 2, 4, 2, 3.

A. 1
B. 2
C. 6
D. 8

48. A population with variance 16 has unknown mean μ. Let $\bar{X}$ be the mean of a random sample of size 100 from this population. If $\bar{X}$ is used to estimate μ. Determine the standard error of $\bar{X}$.

A. 16.00
B. 100.00
C. 0.40
D. 0.16

49. What is the mean value of a binomial variate whose number of repeated trials (n) equal to 8 and probability of success (p) equals 0.4

A. 8
B. 4
C. 3.2

D. 1.92

50. The probability that a patient will die while undergoing a delicate heart operation is 0.175. What is the probability of the patient surviving from the operation?

A. 0.0875
B. 0.325
C. 0.350
D. 0.825

CHECK YOUR ANSWERS

*Would you like to get or confirm the **correct answer(s)** to any or all of these questions?*

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SECTION A

MULTIPLE CHOICE QUESTIONS

Time Allowed: 1 Hour

Answer All Questions.

1. Find the non-zero negative value of x which satisfies the equation $\begin{vmatrix} x & 1 & 0 \\ 1 & x & 1 \\ 0 & 1 & x \end{vmatrix} = 0$

A. 2

B. -2

C. $\sqrt{2}$

D. $-\sqrt{2}$

2. If $Z = \begin{bmatrix} 2 & 3 & 3 \\ 4 & 1 & 0 \\ 1 & 4 & 0 \end{bmatrix}$ find determinant of Z.

A. 35

B. 45

C. -35

D. 48

3. Compute $\left(1 + \frac{3}{1+i}\right)^2$

A. $\frac{-8}{2} - \frac{15}{2}i$

B. $4 - \frac{15}{2}i$

C. $\frac{17}{2} - \frac{15}{2}i$

D. 4

4. Find the centre and radius of the circle $8x^2+8y^2-24x-40y+18=0$.

A. (3/2, 5/2) and r = 3/2

B. (-3/2, 5/2) and r = 5/2

C. (3/2, -5/2) and r = 3/2

D. (3/2, 5/2) and r = 5/2

5. Find the equation of the tangent to the circle $2x^2 + 2y^2 = 30$ at the point $(-3, 6)$.

A. x + y − 15=0

B. x − 2y + 5=0

C. x + 2y − 5=0

D. x − 2y+15=0

6. Given the equations of the ellipse $x^2/2+y^2=1$. Find the equation of the directrices.

A. $x = (0, \pm1)$

B. $x = (0, \pm2)$

C. $x = (0, \pm3)$

D. $x = (0, \pm4)$

7. Find the gradient of the curve $y = x^3 - 6x^2 + 11x - 6$ at the point $(1, 0)$

A. -1

B. -2

C. 1

D. 2

8. Given sets $A = \{a, b, 1, 3\}$ and $B = \{a, 2, 4\}$, find $A \cup B$.

A. $\emptyset$

B. $\{a, b, 1, 2, 3, 4\}$

C. $\{a, b, 1, 3\}$

D. $\{b, 1, 2, 3, 4\}$

9. Let P be the set of prime factors of 42 and Q be the set of prime factors of 45. Find $P \cap Q$.

A. $\{2\}$

B. $\{3\}$

C. $\{7\}$

D. $\{5\}$

10. A polynomial $2x^3 + ax^2 + bx - 1$ has a factor $(x-1)$ and the remainder when it is divided by $(x-2)$ is -4. Find $a + b$.

A. -1

B. 1

C. -2

D. 2

11. Solve the equation $\log_3 x + \log_x 3 = \frac{10}{3}$

A. $\sqrt{3}, 9$

B. $27, \sqrt{3}$

C. $10, 9$

D. $27, \sqrt[3]{3}$

12. Solve the equation $\sqrt{2x + 3} - \sqrt{(x - 2)} = 2$

A. 3, 6

B. 3, 11

C. 27, 3

D. 3, 10

13. If $y = x(x^6 - 1)$, find the range for which $y = 0$.

A. $(-\infty, 0) \cup (0, \infty)$

B. $(-1, -\infty) \cup (0, \infty)$

C. $[-1, 0) \cup [0, 1]$

D. $(-\infty, \infty)$

A. 5

B. 0

C. 2

D. ∞

14. Evaluate $\lim\limits_{x\to -3}\left\{\dfrac{3x^2-27}{x+35}\right\}$

A. -18

B. 9

C. 0

D. 3

15. Evaluate $\int_1^e \dfrac{1}{x}dx$

A. 0

B. 2

C. 1

D. 2e

16. Evaluate $\int_0^{\frac{\pi}{2}} \cos x\, dx$

A. 2

B. 7

C. -1

D. 1

17. Evaluate $\lim\limits_{x\to\infty}\left\{\dfrac{2x^3+x^2-5}{x^3+2x+1}\right\}$

18. The expression px^2 + qx + r equals 4 $at\ x$ = 1. If the derivative is 2x + 1, what are the values of p, q and r respectively?

A. 1, 1, 2

B. 1, 2, 1

C. 1, 0, 1

D. 1, -1, 2

19. The gradient of a curve at any point (x, y) is given by 2x + 3. If the curve passes through the origin, find the equation of the curve.

A. x (x + 2)

B. x (2x + 3)

C. $x^2 - 4$

D. 2x + 3

20. The position of an object in motion at any time (t) is given by

$s = 3t^3 - 5t - 2$. Obtain the velocity of the object after 2 seconds.

A. 31m/s
B. 36m/s
C. 18m/s
D. 20m/s

21. Find the derivative of $2x^3 - 5x^2 + 2$

A. $x^2 - 10x$
B. $6x^2 - 10x$
C. $-10x - 6x^2$
D. $6x - 10$

22. Find the derivative of $y = (3 + 2x)(1 - x)$

A. $-1 - 4x$
B. $4x - 1$
C. $-4x + 1$
D. $- 4x$

23. Differentiate $(x + y)^2 = 5$.

A. $- 4$
B. $- 2$
C. $- 1$

D. 10

24. Evaluate: $\lim\limits_{x \to 5} \dfrac{x^2 - 25}{x - 5}$

A. 5
B. 15
C. 10
D. 12

25. If $y = (x - 1)\, e^{-x}$, find $\dfrac{dy}{dx}$

A. $(2 - x)\, e^{-x}$
B. $e^x\, 2x$
C. $- x\, e^x$
D. $2x$

26. Find the modulus of $2i + 3j - 4k$

A. $\sqrt{12}$
B. $\sqrt{29}$
C. $\sqrt{3}$
D. $\sqrt{28}$

27. Find the scalar products of $a = 2i + 3j$ and $b = - i + 4j$

A. 20
B. 10
C. -10

D. -20

28. Find the value of n for which the vector $si + nj - 3k$ and $ni - j + 5k$ are perpendicular.

A. 90

B. 0°

C. $\frac{15}{s-1}$

D. $\frac{s-1}{15}$

29. Obtain the projection of vector a = (3, -1.5) on the vector b = (2.1, -3)

A. $\frac{-2}{\sqrt{14}}$

B. $\frac{-2}{\sqrt{35}}$

C. $\sqrt{14}$

D. $\sqrt{35}$

30. Find the volume of the tetrahedron OABC with point A (2,1,1), B (0,-1,1) and C (-1,3,0).

A. $^2/_5$

B. $^3/_4$

C. $^4/_3$

D. $-^4/_3$

31. The distance S in meters (m) moved by a particle in t time in seconds (s) is given by $S = 1.5t^2 - t$. Find its speed after t seconds.

A. 3t m/s

B. (3t-1)m/s

C. (3t+1)m/s

D. (1-3t)m/s

32. A car starts from A and travels 10km due West, 20km North-West and 30km due North. Find the displacement from A.

A. 51.3km

B. 53.3km

C. 43km

D. 50.3km

33. The brakes of a train are able to produce a retardation of 1.2m/s. if the train is travelling at 90km/h, at what distance from a station should the brakes be applied.

A. 200m

B. 250m

C. 260m

D. 240m

34. A particle is projected with a velocity of 20m/s up a smooth inclined plane of inclination 30°. Find the distance described up the plane.

A. 40.8m

B. 48m

C. 40m

D. 38m

35. A block of mass 20kg rests on a horizontal plane whose coefficient of friction is 0.4. Find the least force required to move the block if it acts horizontally.

A. 190N

B. 80N

C. 196N

D. 78.4N

36. A mass of 8kg hangs in equilibrium, suspended by two light inelastic strings making angles 30° and 45° with the horizontal, calculate the tensions in the two strings.

A. 57.4N, 70.3W

B. 50N, 70W

C. 60.5N, 60.5W

D. 50N, 50W

37. If $\vec{a} = 2i + 3j + 5k$, $\vec{b} = 3i - 5j + 2k$, $\vec{c} = i - j$. Calculate λ such that $2\vec{a} - 5\vec{b} + \lambda\vec{c}$ is perpendicular to the $x - axis$.

A. 8

B. 9

C. 10

D. 7

38. The probabilities that John and Joanna will passed an examination are $\frac{2}{3}$ and $\frac{4}{5}$ respectively. Find the probability that only one of them will pass.

A. $\frac{2}{15}$

B. $\frac{4}{15}$

C. $\frac{1}{15}$

D. $\frac{6}{15}$

39. In how many ways can a committee of 2 men and 2 women be formed from 3 men and 5 women?

A. 12

B. 30

C. 20

D. 10

40. The formular for Spearman's rank correlation is:

A. $1 + \frac{6\sum d^2}{N(N^2-1)}$

B. $1 - \frac{\sum d^2}{N(N^2-1)}$

C. $1 - \frac{6\sum d^2}{N(N^2-1)}$

D. $1 - \frac{6\sum d^2}{N^2}$

41. The following are continuous random variables except _____

A. The temperature of an object

B. The distance between two points

C. The population of a school

D. The marks obtained by a group students

42. The following are features of a standard normal curve except _____

A. It is bell-shaped

B. The area under the curve is 1

C. It is symmetric about the mean

D. The variance is zero

43. An experiment in which the outcomes are two possibilities: "Success" or "failure" is said to be _____

A. Binomial

B. Normal

C Geometric

D. Bernoulli

44. The range of values of rank correlation (r_{rank}) is _____

A. -1 < r_{rank} < 1

B. 0 < r_{rank} < 1

C. -1 < r_{rank} < 0

D. $r_{rank} > 1$

45. Find the geometric mean of the data: 5, 15, 10, 8, 12.

A. 72000

B. 821.1

C. 9.36

D. 10

46. One can easily determine the _____ of a distribution from histogram.

A. mean

B. mode

C. median

D. standard deviation

47. Find the mean of the following scores

Scores (x)	61	64	67	70	73
Freq. (f)	5	18	42	27	8

A. 65

B. 67.45

C. 67

D. 68

48. What is the mode of the following numbers 1, 8, 8, 10, 9, 2, 7, 8, 2, 2, 4, 1, 1, 8, 7, 1

A. 8

B. 8 and 1

C. 1

D. None of the above

49. The _____ level of a test is the maximum probability of committing Type I error when the null hypothesis holds.

A. acceptance

B. rejection

C. significance

D. significant

50. The standard deviation of a statistic describes _____

A. the shape of its distribution.

B. the centre of its distribution.

C. the amount of skewness associated with its distribution.

D. the amount of variability associated with its distribution.

DISCLAIMER

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