

JMET PAPER: (13-12-2009)

SECTION 3: QUANTITATIVE ABILITY

(Questions 61 - 90)

Directions: Questions 61 and 62 are based on the following information:

Manufacturing of two automotive gear products, A and B, requires processing in both machines 1 and 2. The time required to manufacture one unit of Product A, on machine 1 and machine 2 are 2 hours and 4 hours respectively. Whereas, the time required for manufacturing one unit of Product B on machine 1 and machine 2, are 3 hours and 1 hour respectively. The total time available for machine 1 and machine 2 on a given working day are 6 hours and 8 hours respectively. There is also a constraint that at least 8 units of A and B together should be produced in a given day. Per unit profit of A and B are Rs. 5 and Rs. 7 respectively. The objective is to maximize the total amount of profit by manufacturing the two products on any given day.

61. If X and Y represent the number of A and B to be produced on a given day respectively, then the mathematical formulation for the daily profit maximization problem is given by:

- | | |
|---|---|
| (A) Max profit = $5X + 7Y$
$2X + 3Y \leq 6$
$4X + Y \leq 8$
$X + Y \geq 8$
$X, Y \geq 0$ and integers | (B) Max profit = $5X + 7Y$
$6X + 8Y \leq 2$
$4X + Y \leq 3$
$X + Y \geq 8$
$X, Y \geq 0$ and integers |
| (C) Max profit = $5X + 7Y$
$2X + 4Y \leq 6$
$3X + Y \geq 8$
$X + Y \geq 8$
$X, Y \geq 0$ and integers | (D) Max profit = $5X + 7Y$
$2X + 3Y \leq 6$
$4X + Y \leq 8$
$X + Y \leq 8$
$X, Y \geq 0$ and integers |

Ans. (A)

62. The values of (X, Y) at which optimality is reached is:

- (A) (0, 8) (B) (8, 0) (C) Infeasible (D) Infinite

Ans. (C)

63. It took 15 hours and 40 minutes for Rakesh to paint four walls and the ceiling of a room of size 900 cu. ft. The ceiling height of the room is 10 ft. If Rakesh painted at a constant rate of 0.5 sq. ft per minute, how long will it take for him to paint the walls?

- (A) 12 hrs. 40 min (B) 11 hrs. (C) 13 hrs. (D) 1 hrs. 10 min.

Ans. (A)

64. Mr. Hague's total annual gross salary, which was Rs. 10 Lakhs per year in 2007, has been reduced by 10% in 2008. In 2007 his family expenditure for food items was 40% of the total annual gross salary. The prices of average food items have increased by 5% between 2007 and 2008. Assuming that the family consumed the same amount of food in 2008, the percentage expenditure on food items, calculated on total annual gross salary in 2008, is approximately:

- (A) 43% (B) 45% (C) 47% (D) 49

Ans. (C)

65. The total number of possible proper three-digit integers that can be formed using 0, 1, 3, 4 and 5 without repetition such that they are divisible by 5 are:
 (A) 30 (B) 21 (C) 22 (D) 24

Ans. (B)

Numbers ending with 0 = $4 \times 3 = 12$

Number ending with 5 = $3 \times 3 = 9$

Total = $12 + 9 = 21$

Directions: The following passage pertains to Questions 66 to 68:

Consider a circular running track of radius "r". Two runners Anand and Ben are on the running track at a distance of " πr " from each other. They always run in a clockwise direction. The running track is such that the runners lose energy on one contiguous half of the track and gain energy in the other contiguous half of the track. Let both Anand and Ben have initial energy levels of "E".

66. Let the runners consume or gain unit energy per unit distance traveled. Also, let the energy consumed or gained be independent of the distance traveled thus far when the energy levels are greater than zero. The runners come to a stop when all their energy is expended. Assuming that both runners run at the same constant speed "s". After traveling a distance of " $2\pi nr$ " where n is a non-negative integer, what is the difference in energy levels of Anand and Ben?
 (A) 0 (B) πr (C) πnr (D) πnrs

Ans. (A)

67. Anand is at the start of the half circle that boosts energy and Ben at the start of the half circle that dissipates energy. Now, if the energy lost or gained per unit distance is proportional to the distance traveled thus far, with "k" being the energy lost or gained per unit distance travelled, what is the difference in the energy levels when Anand reaches the position of Ben and vice-versa?
 (A) $2k\pi r$ (B) $k\pi^2 r^2$ (C) $k\pi^2 r^2/2$ (D) $k\pi r/2$

Ans. (A)

68. Assume that the position of Anand on the track is chosen randomly and Ben is at a distance of " πr " from Anand. What could have been the maximum possible difference in the energy levels between them during the process of completing one full circle?
 (A) 0 (B) πr (C) $2\pi r$ (D) $\pi r/2$

Ans. (C)

69. Consider the internal angle between any two contiguous sides of the largest regular polygon of N sides drawn inside a circle. Which of the following graphs represents the internal angle between two contiguous sides as a function of N?

Ans. (A)

70. Let x denote the greatest 4-digit number which when divided by 6, 7, 8, 9 and 10 leaves a remainder of 4, 5, 6, 7 and 8 respectively. Then, the sum of the four digits of x is:
 (A) 25 (B) 18 (C) 20 (D) 22

Ans. (A)

71. If the roots of the equation $2ax^2 + 2ax + 1 = 0$ are real and distinct, then the number of possible integer value(s) a can take between 1 and 4 (inclusive) is:
 (A) 1 (B) 4 (C) 3 (D) 2

Ans. (D)

72. A Finn produces x units of tyres ($x > 0$) at a total cost of Rs $(100x - 30x^2 + \frac{1}{3}x^3)$. Then the average cost per tyre is minimized for x equal to:
 (A) 40 (B) $60 - 40\sqrt{2}$ (C) $60 + 40\sqrt{2}$ (D) 45

Ans. (D)

73. A father runs after his son, who is 1000 meters ahead. The father runs at a speed of 1 kilometer every 8 minutes, and the son runs at a speed of 1 kilometer every 12 minutes. How much distance has the son covered at the point when the father overtakes him?
 (A) 2500 meters (B) 2000 meters (C) 1500 meters (D) 1000 meters

Ans. (B)

74. A man jogging inside a railway tunnel at a constant speed hears a train approaching the tunnel from behind at a speed of 30 km per hour, when he is one third of the way inside the tunnel. Whether he keeps running forward or turns back, he will reach the end of the tunnel at the same time the train reaches that end. The speed at which the man is running is:
 (A) 6 km per hour (B) 8 km per hour (C) 12 km per hour (D) 10 km per hour

Ans. (D)

75. If there are six distinct points on a plane, what is the maximum number of straight lines joining the points?
 (A) 9 (B) 12 (C) 18 (D) 15

Ans. (D)

76. After purchasing four mangoes, a man commented: "well, if the price of a mango was Rs. 4 less, I would have got two more mangoes for the same amount of money I have now paid". What is the price of one mango?
 (A) Rs. 8 (B) Rs. 10 (C) Rs. 15 (D) Rs. 12

Ans. (D)

77. A child consumed an ice cream of inverted right-circular conical shape from the top and left only 12.5% of the cone for her mother. If the height of the ice cream-cone was 8 cm, what was the height of the remaining ice cream-cone?
 (A) 2.5 cm (B) 3.0 cm (C) 3.5 cm (D) 4.0 cm

Ans. (D)

78. Consider a square, S which is inside a circle A such that the four corner points of the square touch the circumference of the circle. A second circle B is inside the square S so that its four sides touches the circumference of B . Then, the ratio of the areas of the circles $A : B$ equals:

- (A) $\sqrt{2} : 1$ (B) $2 : 1$ (C) $\sqrt{3} : 1$ (D) $\pi : 1$

Ans. (B)

79. If a, b and c are roots of $x^3 - 6x^2 + 11x - 6 = 0$ and the roots of the equation $x^3 - px^2 + qx - r = 0$ are $a + b, b + c$ and $c + a$, then r equals:

- (A) 40 (B) 50 (C) 60 (D) 70

Ans. (C)

80. The amount of heat flow across a metal wall is proportional to the surface area of that wall and inversely proportional to the thickness of the same wall. The heat flow is also proportional to the difference of temperatures maintained across the two sides of the wall. In a certain situation a square wall was replaced by another having sides $1\frac{1}{2}$ times the previous wall and the thickness increased by 80%. To what extent should the temperature difference be changed so as to have the same heat flow?

- (A) 25% decrease (B) 20% decrease (C) 20% increase (D) 25% increase

Ans. (B)

81. There are three similar boxes, containing (i) 6 black & 4 white balls; (ii) 3 black & 7 white balls and (iii) 5 black & 5 white balls, respectively. If you choose one of the three boxes at random and from that particular box pick up a ball at random, and find that to be black, what is the probability that the ball was picked up from the second box?

Ans. (A)

82. A regular pyramid has a square base with side 10 cm and a vertical height of 20 cm. If the height increases by 10% of its original value and the volume is constant, the percentage change in the side of the square base with respect to its original value is approximately:

- (A) + 5% (B) + 10% (C) - 5% (D) - 10%

Ans. (C)

83. Let $f(\cdot)$ be a function defined on the set of positive integers, such that $f(n) = n + f(n - 1)$ and $f(1) = 1$, then $f(100)$ equals:

- (A) 4900 (B) 4950 (C) 5000 (D) 5050

Ans. (D)

84. A semi-circle of diameter 14 cm has three chords of equal length connecting the two end points of the diameter so as to form a trapezoid inscribed within the semi-circle. What is the value of the area enclosed by the trapezoid?

Ans. (C)

85. A right circular hollow cylinder, kept vertically on its circular base has a height of 20 cm and radius of 10 cm. A sugar grain is kept inside this cylinder on its circular base at the periphery. If an ant is at the top rim of the same cylinder and diagonally opposite the sugar grain, the minimum distance the ant should travel to reach the sugar grain is approximately:

(A) 82.86 cm (B) 51.43 cm (C) 37.25 cm (D) 65.96 cm

Ans. (C)

86. A goat is tethered to one end of a rope of length 20 meters, while the other end is fixed at the centre of a large circular field. There is a square elevated platform with sides of 10 meters on the field such that one corner of the elevated square platform coincides with the centre of the circular field. If the goat is unable to mount the square elevated platform, what is the total area that the goat will be able to graze'?

(A) $3 \times 100\pi$ (B) $3.5 \times 100\pi$ (C) $4 \times 100\pi$ (D) $100(3\pi + 1)$

Ans. (B)

87. Two cities A and B, at a distance of 50 km, are connected by two separate roads. The speed of any vehicle travelling between the two cities on road 1 is 50 km per hr, while the speed on road 2 is $(80/n)$ km per hr, where n is the number of vehicles (including the concerned vehicle). If you travel in a vehicle from A to B on road 1 and come back from B to A on road 2 (where there are already three vehicles plying), your approximate average speed is:

(A) 26 km per hr (B) 29 km per hr (C) 32 km per hr (D) 35 km per hr

Ans. (B)

88. In practical inventory problems, the total cost (TC) of ordering and carrying the inventory, is expressed as,

Ans. (C)

Directions for Questions 89 and 90: Using two vertical and two horizontal grid lines, a square is divided into nine equal smaller squares of the same size, and marked by numbers 1 to 9. Nine different coins weighing 0.2 gm, 0.4 gm, 0.6 gm, 0.8 gm, 1.0 gm, 1.2 gm, 1.4 gm, 1.6 gm and 1.8 gm are to be placed, one in each square:

89. If the sum of the weights along the three rows, the three columns and the two diagonals are the same, how many different arrangements are possible?

(A) 2 (B) 4 (C) 8 (D) 10

Ans. (B)

90. If sum of the weights along the rows and columns are the same, but the sum of the weights along one diagonal is double the other, how many different arrangements are possible'?

(A) 6 (B) 8 (C) 9 (D) 10

Ans. (B)