Question 1

Question: During a railway network stress test, two high-speed trains are to depart simultaneously from a central hub along radially opposing tracks. Train A operates at a constant velocity of 50 km/h, while Train B runs at 60 km/h. The control system requires calculating their separation distance after exactly 4 hours to assess signal interference. Derive this value using the fundamental motion equation.
Options:
A) 450 km
B) 420 km
C) 480 km
D) 440 km
Answer: D) 440 km

Question 2

Question: A displacement of 100 kilometers is executed over a cumulative time frame of 4 hours. The journey is segmented into two discrete phases: the first governed by a velocity constraint of 20 km/h, and the second by a velocity of 40 km/h. Determine the temporal extent attributable to the initial phase under the assumption of uninterrupted motion.
Options:
A) 1 hour
B) 2 hours
C) 4 hours
D) 3 hours
Answer: D) 3 hours

Question 3

Question: A financial portfolio reflects an upward trajectory as an initial capital of $2,000 evolves to $3,600 over a 3-year holding period. While the total appreciation is evident numerically, what remains less immediately clear is the uniform year-on-year growth rate that would have yielded the same result under consistent performance? (Use round off)
Options:
A) 30%
B) 25%
C) 36%
D) 22%
Answer: D) 22%

Question 4

Question: In a 2x3 factorial design with 4 replications, what is the total number of observations?
Options:
A) 24
B) 18
C) 12
D) 36
Answer: A) 24

Question 5

Question: A depreciation report on high-value assets shows a vehicle value reduction due to wear and tear at a compounded annual rate of 10%. As of now, the book value of the vehicle is $18,000. Determine the asset's value after 2 years, assuming the rate remains consistent and uninterrupted.
Options:
A) $14,580
B) $15,120
C) $16,200
D) $14,400
Answer: A) $14,580

Question 6

Question: A logistics company analyzes a delivery worker's route efficiency. Walking at 6 km/h, he reaches a distribution center in 2 hours. If his speed increases to 9 km/h, determine the time saved.
Options:
A) 30 min
B) 50 min
C) 40 min
D) 60 min
Answer: C) 40 min

Question 7

Question: A wholesaler inflates the price tag of an item to 40% above the procurement cost. However, a 25% discount is applied at the point of sale relative to that elevated figure. For an item sourced at $800, determine the net sale price after all adjustments.

Options:
A) $840
B) $960
C) $900
D) $950
Answer: B) $960

Question 8

Question: While analyzing the performance of two algorithms running in parallel, a data scientist observed that the arithmetic mean of execution times is 48 ms, and the geometric mean is 24 ms. What is the harmonic mean?
Options:
A) 16
B) 18
C) 22
D) 20
Answer: A) 16

Question 9

Question: A train traveling at a uniform speed of 54 km/h approaches and crosses a bridge. The train is 300 m long, and the bridge spans 120 m. How long will it take for the train to completely cross the bridge?
Options:
A) 28 seconds
B) 32 seconds
C) 36 seconds
D) 24 seconds
Answer: B) 28 seconds

Question 10

Question: An architect is designing a scaled monument in the form of a pyramid open-air installation. The blueprint specifies a perfectly square base, with each side measuring exactly 4 meters. Rising vertically from the center of the base to the apex, the height of the structure is 9 meters. While the base area is easily measurable, engineers must calculate the volume enclosed within the pyramid. What is the total volume?
Options:
A) 54 m^3

B) 36 m^3
C) 48 m^3
D) 64 m^3
Answer: A) 54 m^3

Question 11

Question: In a Bayesian structural time series model, the local level model has state equation $\mu_t = \mu_{t-1} + \eta_t$, and observation equation $y_t = \mu_t + \varepsilon_t$, where $\eta_t \sim N(0, Q)$ and $\varepsilon_t \sim N(0, R)$. The signal-to-noise ratio is $q = Q/R$. If the Kalman gain at steady state is $K = (\sqrt{q^2 + 4q} - q)/2$, what is K when q = 0.25?
Options:
A) 0.414
B) 0.5
C) 0.39
D) 0.318
Answer: A) 0.414

Question 12

Question: A metal cylinder is being designed for a pressure testing rig. The final object must contain an internal volume of exactly 1256 cubic centimeters. The height is precisely 10 centimeters. Using $\pi = 3.14$, determine the radius of the base.
Options:
A) 6 cm
B) 8 cm
C) 5 cm
D) 7 cm
Answer: B) 8

Question 13

Question: In a 3×4×2 factorial design with 5 replications, what is the total number of observations?
Options:
A) 123
B) 130
C) 120
D) 129
Answer: C) 120

Question 14

Question: A Bayesian network with 5 nodes arranged as a directed acyclic graph in the structure A → B → C → D → E. If each node has 3 possible states, what is the minimum number of conditional probability parameters needed to fully specify this network?
Options:
A) 34
B) 24
C) 18
D) 15
Answer: B) 24

Question 15

Question: Among 150 students surveyed at a university, 70 play cricket, 80 play football, and 60 play basketball. When overlapping participation was examined, it was found that 40 students play both cricket and football, 30 play both cricket and basketball, and 35 play both football and basketball. Further, 20 students play all three sports. Based on this data, how many students participate in exactly two of these sports but not all three?
Options:
A) 55
B) 45
C) 50
D) 40
Answer: C) 50

Question 16

Question: A panel data model with fixed effects uses the within transformation. Given T = 5 time periods and N = 100 cross-sectional units, and including K = 3 regressors, what are the degrees of freedom for the F-test of overall significance?
Options:
A) (397, 3)
B) (400, 3)
C) (497, 3)
D) (397, 9)
Answer: A) (397, 3)

Question 17

Question: In a vector autoregression (VAR) model with p = 3 lags and k = 4 variables, including a constant term, what is the total number of parameters to be estimated per equation?
Options:
A) 15
B) 13
C) 12
D) 16
Answer: A) 15

Question 18

Question: The Ledoit–Wolf shrinkage estimator is $\Sigma = (1 - p)S + pF$ where S is the sample covariance, F is the structured estimator, and $p = \min(\ ||S - F||^2\_F\ /\ ||S||^2\_F\ ,\ 1)$. If $||S - F||^2\_F = 25.6$ and $||S||^2\_F = 64.0$, what is the shrinkage intensity p?
Options:
A) 0.7
B) 0.9
C) 0.4
D) 0.8
Answer: C) 0.4

Question 19

Question: A leap year begins with March 20th — the official start of spring — falling on a Wednesday. What day of the week will December 20th — the final day of autumn that same year — fall on?
Options:
A) Monday
B) Tuesday
C) Wednesday
D) Friday
Answer: B) Tuesday

Question 20

Question: In a Markov Chain Monte Carlo (MCMC) simulation using the Metropolis–Hastings algorithm, the acceptance rate is 23%. For optimal efficiency in sampling from a normal distribution, the target acceptance rate should be approximately what percentage?
Options:

A) 35%
B) 44%
C) 60%
D) 23%
Answer: D) 23%

Question 21

Question: An architectural blueprint includes a swimming pool designed as a cuboid, stretching 25 meters long, 10 meters wide, and reaching 4 meters deep. However, for maintenance and safety reasons, the pool is typically filled only to 75% of its total capacity. Determine the actual volume of water in the pool under regular operating conditions.
Options:
A) 750 m^3
B) 1000 m^3
C) 1250 m^3
D) 1500 m^3
Answer: B) 750 m^3

Question 22

Question: A perfect sphere is snugly inscribed inside a cube, meaning it touches all faces of the cube from the inside. The total volume of the cube is 729 cubic centimeters. The diameter of the sphere equals the cube's edge length. Using π = 3.14, find the surface area of the sphere (rounded to the nearest whole number).
Options:
A) 139 cm^2
B) 255 cm^2
C) 252 cm^2
D) 378 cm^2
Answer: D) 378 cm^2

Question 23

Question: An investment worth $2500 is subjected to compound interest at an annual rate of 5% over a period of 3 years. Interest is compounded annually. What is the total compound interest earned at the end of the period?
Options:
A) $404.00
B) $375

C) $495.00
D) $394.00
Answer: A) $404.00

Question 24

Question: A depreciation report on high-value assets shows a vehicle value reduction due to wear and tear at a compounded annual rate of 10%. As of now, the book value of the vehicle is $18,000. Determine the asset's value after 2 years, assuming the rate remains consistent and uninterrupted.
Options:
A) $14,580
B) $15,120
C) $16,200
D) $14,400
Answer: A) $14,580

(duplicate of Q5 but appears in your provided set twice)

Question 25

Question: A logistics company analyzes a delivery worker's route efficiency. Walking at 6 km/h, he reaches a distribution center in 2 hours. If his speed increases to 9 km/h, determine the time saved.
Options:
A) 30 min
B) 50 min
C) 40 min
D) 60 min
Answer: C) 40 min

(duplicate of Q6)

Question 26

Question: A wholesaler inflates the price tag of an item to 40% above the procurement cost. However, a 25% discount is applied at the point of sale relative to that elevated figure. For an item sourced at $800, determine the net sale price after all adjustments.
Options:
A) $840
B) $960

C) $900
D) $950
Answer: B) $960

(duplicate of Q7)

Question 27

Question: While analyzing the performance of two algorithms running in parallel, a data scientist observed that the arithmetic mean of execution times is 48 ms, and the geometric mean is 24 ms. What is the harmonic mean?
Options:
A) 16
B) 18
C) 22
D) 20
Answer: A) 16

(duplicate of Q8)

Question 28

Question: A train traveling at a uniform speed of 54 km/h approaches and crosses a bridge. The train is 300 m long, and the bridge spans 120 m. How long will it take for the train to completely cross the bridge?
Options:
A) 28 seconds
B) 32 seconds
C) 36 seconds
D) 24 seconds
Answer: A) 28 seconds

(duplicate of Q9)

Question 29

Question: An architect is designing a scaled monument in the form of a pyramid open-air installation. The blueprint specifies a perfectly square base, with each side measuring exactly 4 meters. Rising vertically from the center of the base to the apex, the height of the structure is 9 meters. While the base area is easily measurable, engineers must calculate the volume enclosed within the pyramid. What is the total volume?

Options:
A) 54 m^3
B) 36 m^3
C) 48 m^3
D) 64 m^3
Answer: A) 54 m^3

(duplicate of Q10)

Question 30

Question: In a Bayesian structural time series model, the local level model has state equation $\mu_t = \mu_{t-1} + \eta_t$, and observation equation $y_t = \mu_t + \varepsilon_t$, where $\eta_t \sim N(0, Q)$ and $\varepsilon_t \sim N(0, R)$. The signal-to-noise ratio is q = Q/R. If the Kalman gain at steady state is K = $(\sqrt{(q^2 + 4q)} - q)/2$, what is K when q = 0.25?
Options:
A) 0.414
B) 0.5
C) 0.39
D) 0.318
Answer: A) 0.414