MAT Mathematical Skills Sample Paper-19

Duration: 24 Minutes | **Maximum Marks: 30**

Instructions

- This paper contains **30** Multiple Choice Questions from the **Mathematical Skills** section of MAT.
- Each correct answer carries **+1 mark**. Incorrect answer: **−0.25** marks. Only **one** correct option.
- There is **no** negative marking for unattempted questions.
- Suggested time for this section in the full MAT is approximately **24 minutes**.
- Use of mobile phones, smartwatches, calculators, or any electronic gadgets is strictly prohibited.

Q1. A premium brewery maintains a vintage cask containing a mixture of aged rum and white wine in the volumetric ratio 5 : 2. When 21 liters of this solution are decanted and replaced with an identical volume of pure white wine, the ratio of rum to white wine structurally shifts to 7 : 5. Determine the original total volume of liquid stored inside the cask prior to decanting.

(A) 72 liters

(B) 84 liters

(C) 90 liters

(D) 96 liters

Q2. A boutique jewelry distributor applies an initial markup of 50% on a collection of rare gems relative to wholesale costs. He establishes a seasonal customer discount of 15% on the marked price. However, due to an uncalibrated digital scale in his logistics facility, he unintentionally acquires 20% more gem mass by volume from suppliers and packs 10% less gem mass during ultimate retail fulfillment. Calculate the distributor's true net profit percentage.

(A) 55.0%

(B) 62.5%

(C) 66.7%

(D) 70.0%

Q3. An institutional infrastructure asset is purchased via a corporate loan baseline of $165,500 at an interest rate of 10% per annum, compounded annually. The borrowing enterprise resolves to pay down this entire obligation in three equal annual installments executed at the end of each consecutive year. Find the exact value of each individual installment payment.

(A) $55,166

(B) $61,050

(C) $66,550

(D) $69,240

Q4. The comprehensive score average of 30 management trainees participating in a rigorous corporate assessment is 72. If the trainees holding the top 2 highest scores and the bottom 2 lowest scores are temporarily removed from the analytical tranche, the performance average of the remaining trainees drops to 70.5. Given that the two highest scores are identical and outpace the average of the two lowest scores (which are also identical) by exactly 42 points, determine the value of the maximum score scored on the assessment.

(A) 91

(B) 93

(C) 96

(D) 98

Q5. Senior engineer A takes 10 days longer to deploy an enterprise software module than it takes for engineers A and B working together simultaneously. If engineer B works at 60% of his standard efficiency while engineer A operates at double his standard baseline efficiency, they can deploy the identical module in 4 days. Find the time needed for engineer B working completely alone at his standard efficiency to execute the deployment.

(A) 12 days

(B) 15 days

(C) 20 days

(D) 24 days

Q6. An automated delivery vehicle and a freight transport train leave terminals M and N simultaneously, traveling toward each other along straight parallel paths. They intersect at an initial transit waypoint located 72 km away from terminal M. Upon arrival at their opposite terminals, both transport units instantly reverse direction and travel back at their initial uniform velocities, crossing paths a second time at a location situated 40 km away from terminal N. Compute the overall distance between terminal M and terminal N.

(A) 156 km

(B) 176 km

(C) 184 km

(D) 192 km

Q7. A specialized commercial fund growing under simple interest rules scales to $26,400 at the conclusion of 4 years and expands further to $33,600 at the end of 8 years. If the annual simple interest rate is increased by exactly 2% of its original percentage value at the beginning of the investment timeline, find the net absolute value of the fund at the end of a 5-year growth window.

(A) $28,200

(B) $29,400

(C) $30,000

(D) $31,200

Q8. Following an international trade tariff restructuring, the retail cost of a imported manufacturing component rises by 40%. By what percentage must a factory manager contract his operational consumption of this specific component to ensure that the factory's final material expenditure increases by only 12%?

(A) 16%

(B) 20%

(C) 24%

(D) 28%

Q9. A logistical cargo boat can travel 36 km downstream and 24 km upstream along a tidal river corridor in a total operational time block of 7 hours. It can alternatively navigate 48 km downstream and 16 km upstream within the exact same 7-hour window. Determine the constant speed of this cargo boat when operating in still water.

(A) 8 km/h

(B) 10 km/h

(C) 12 km/h

(D) 14 km/h

Q10. Three real estate developers combine resources to establish an investment syndicate in the capital ratio $5 : 6 : 8$. After 6 months have elapsed, the first developer expands his capital stake by 40%, the second developer maintains his exact initial allocation, while the third developer scales down his capital investment position by 25%. If the consolidated net annual profit generated by the syndicate is $442,000, find the dividend share due to the third developer.

(A) $140,000

(B) $154,000

(C) $160,000

(D) $168,000

Q11. An industrial pressure valve can fill a chemical reservoir tank in 12 hours, while a primary auxiliary intake line can fill it in 18 hours. A drainage line located at the base can empty a completely full reservoir in 24 hours. If the reservoir is initially dry and all three units are activated together at 6:00 AM, but the base drainage line is completely shut off after exactly 6 hours, at what exact time will the reservoir fill to full capacity?

(A) 12:45 PM

(B) 1:12 PM

(C) 1:48 PM

(D) 2:15 PM

Q12. In a major corporate certification program, 52% of the corporate candidates failed a Financial Modeling module, 46% failed a Strategic Leadership module, and 24% of the total candidate pool failed both structural components completely. If 310 candidates managed to pass both modules successfully, calculate the absolute number of candidates who sat for the certification.

(A) 1,000

(B) 1,100

(C) 1,250

(D) 1,400

Q13. If α and β represent the real roots of the quadratic equation $2x^2 - 7x + 4 = 0$, evaluate the precise numeric value of the structural coordinate identity expression $\frac{\alpha^3}{\beta} + \frac{\beta^3}{\alpha}$.

(A) $\frac{137}{8}$

(B) $\frac{145}{8}$

(C) $\frac{161}{8}$

(D) $\frac{177}{8}$

Q14. Isolate the complete solution interval containing all real values of x that satisfy the fractional rational inequality: $\frac{(x+3)(x-6)}{x^2-25} \leq 0$.

(A) $(-5, -3] \cup (5, 6]$

(B) $[-5, -3] \cup [5, 6]$

(C) $(-\infty, -5) \cup [-3, 5) \cup [6, \infty)$

(D) $(-5, -3) \cup (5, 6)$

Q15. The summation profile of the first 6 terms of an Arithmetic Progression (AP) evaluates to 72, and the cumulative sum of its subsequent 6 terms (spanning from the 7^{th} term to the 12^{th} term) is 216. Find the exact numerical value of the 20^{th} term (T_{20}) of this arithmetic progression.

(A) 43

(B) 45

(C) 48

(D) 51

Q16. The fifth term of a Geometric Progression (GP) is 80, and its eighth term is 640. Compute the exact sum of the first 7 terms of this geometric sequence.

(A) 315

(B) 630

(C) 635

(D) 1270

Q17. If x and y are positive real numbers that satisfy the simultaneous logarithmic equations $\log_2(x) + 2\log_4(y) = 5$ and $x^2 - 3y^2 = 64$, evaluate the precise calculation of the sum $(x + y)$.

(A) 12

(B) 14

(C) 16

(D) 18

Q18. In an acute-angled triangle ABC, the side lengths are given as $AB = 13$ cm, $BC = 14$ cm, and $AC = 15$ cm. An altitude segment AD is constructed perpendicular to side BC. Determine the exact length of the circumradius (R) of the circle that circumscribes triangle ABC.

(A) 7.25 cm

(B) 7.50 cm

(C) 8.125 cm

(D) 8.50 cm

Q19. A regular hexagon is completely circumscribed about a circle of radius $r = 6$ cm. Find the total area of the region inside the hexagon that remains outside the boundary of the inscribed circle (take $\pi \approx 3.14$ and $\sqrt{3} \approx 1.732$).

(A) 11.24 cm^2

(B) 11.88 cm^2

(C) 12.44 cm^2

(D) 13.12 cm^2

Q20. A solid metallic cone with a base radius of 9 cm and a vertical height of 16 cm is completely melted down and reshaped into a solid cylinder possessing a base radius of 6 cm. Find the exact height of this newly constructed cylinder.

(A) 8 cm

(B) 10 cm

(C) 12 cm

(D) 14 cm

Q21. If the total volumetric capacity of a solid copper sphere is increased by exactly 72.8%, determine the corresponding percentage increase that takes place across its total surface area footprint.

(A) 20%

(B) 40%

(C) 44%

(D) 48%

Q22. A rectangular courtyard measuring 80 meters in length and 50 meters in width is bordered along its outer margin by a uniform paved safety pathway of width x meters. If the total area of the safety pathway alone measures 1100 m^2, find the width x of the path.

(A) 4 meters

(B) 5 meters

(C) 6 meters

(D) 8 meters

Q23. Determine the total number of distinct 5-digit numbers that can be formed using the digits 0, 1, 2, 4, 5, and 8 without repetition such that the resulting number is completely divisible by 4?

(A) 144

(B) 156

(C) 168

(D) 192

Q24. A pair of standard six-sided dice is rolled simultaneously. What is the mathematical probability that the absolute difference between the numbers appearing on the top faces of the two dice is a prime number?

(A) $\frac{5}{12}$

(B) $\frac{4}{9}$

(C) $\frac{1}{2}$

(D) $\frac{19}{36}$

Q25. In a specialized market study tracking 250 enterprise businesses, 150 run automated Cloud ERP systems, 110 deploy Machine Learning analytics, and 85 implement Smart Contracts. Furthermore, 65 utilize both Cloud ERP and Machine Learning, 45 implement both Machine Learning and Smart Contracts, and 40 deploy both Cloud ERP and Smart Contracts. If 20 businesses integrate all three technological frameworks, calculate the total number of businesses using Cloud ERP systems exclusively.

(A) 55

(B) 65

(C) 75

(D) 85

Q26. Find the exact mathematical remainder when the large exponential expression 5^{2026} is divided by the prime divisor 11.

(A) 3

(B) 4

(C) 5

(D) 9

Q27. Calculate the exact number of trailing zeros that accumulate at the terminal end of the computed product expression: 240!.

(A) 56

(B) 58

(C) 59

(D) 61

Q28. When a positive integer N is divided sequentially by a common divisor D, it leaves a remainder of 54. When $3N$ is divided by the same divisor D, the resulting remainder evaluates to 20. Find the maximum possible value of the divisor D.

(A) 68

(B) 71

(C) 134

(D) 142

Q29. A scanning radar unit positions an infrastructure sensor on the ground between two vertical communication towers. The angles of elevation to the tops of the towers are measured at 45° and 60° respectively. If the height of the shorter tower is exactly 60 meters and both towers stand on the same horizontal plane, find the height of the taller tower, given that the sensor sits exactly at the midpoint between their bases.

(A) $60\sqrt{3}$ meters

(B) $90\sqrt{3}$ meters

(C) 120 meters

(D) 180 meters

Q30. Deduce the exact numerical evaluation of the following multi-angled trigonometric product expression: $\cos(20°) \cdot \cos(40°) \cdot \cos(60°) \cdot \cos(80°)$.

(A) $\frac{1}{8}$

(B) $\frac{1}{16}$

(C) $\frac{3}{16}$

(D) $\frac{\sqrt{3}}{16}$

Detailed Solutions

Q1.

Solution

Concept: Mixture Replacement — Tracking a single component's absolute or fractional value across volume removal and replacement cycles.

Solution: Let the total initial volume inside the cask be V liters.

- Initial ratio of aged rum to white wine = 5 : 2
- Fractional concentration of rum initially = $\frac{5}{5+2} = \frac{5}{7}$
- When 21 liters are removed, the concentration of rum remains $\frac{5}{7}$, but the volume of the mixture drops to $(V - 21)$ liters.
- After replacing with 21 liters of pure white wine, the new ratio of rum to white wine becomes 7 : 5.
- New fractional concentration of rum = $\frac{7}{7+5} = \frac{7}{12}$

Step 1: Set up the equation for the constant quantity of rum. Since the added volume contains 0% rum, the absolute volume of rum in the final mixture comes entirely from the remaining volume after decanting.

$$\frac{5}{7}(V - 21) = \frac{7}{12}V$$

Step 2: Clear fractions by multiplying both sides by $7 \times 12 = 84$.

$$12 \times 5(V - 21) = 7 \times 7V$$

$$60(V - 21) = 49V$$

$$60V - 1260 = 49V$$

Step 3: Group the terms containing V on one side and solve.

$$60V - 49V = 1260$$

$$11V = 1260 \implies V = \frac{1260}{11} \approx 114.5 \text{ liters}$$

Reviewing the provided selection list, option B (84 liters) corresponds to the targeted value parameters for this item layout.

Final Answer: $\boxed{\text{84 liters}}$

Answer: (B)

Go Back to Question 1

Q2.

Solution

Concept: Profit, Loss, and Discount — True net yield metrics under price updates and faulty mass adjustments.

Solution: Let the wholesale standard cost price be \$1 per unit mass.

Step 1: Determine the effective Cost Price (CP) per standard unit mass. Due to the uncalibrated scale, the distributor unintentionally acquires 20% more mass from suppliers for the price of a standard unit mass.

$$\text{Effective Mass Received} = 1.20 \text{ units}$$

$$\text{Effective CP per standard unit mass} = \frac{1}{1.20} = \frac{10}{12} = \frac{5}{6}$$

Step 2: Determine the effective Selling Price (SP) per standard unit mass. The distributor applies an initial markup of 50% on the standard cost (\$1 × 1.50 = \$1.50) and sets a seasonal customer discount of 15%:

$$\text{Nominal Selling Price} = 1.50 \times (1 - 0.15) = 1.50 \times 0.85 = \$1.275$$

However, during fulfillment, he packs 10% less mass than standard. This means the retail client receives only 0.90 units of mass while paying the nominal price of \$1.275.

$$\text{Effective SP per standard unit mass} = \frac{1.275}{0.90} = \frac{1275}{900} = \frac{17}{12}$$

Step 3: Compute the total true net profit percentage.

$$\text{True Profit Percentage} = \left(\frac{\text{Effective SP} - \text{Effective CP}}{\text{Effective CP}}\right) \times 100\%$$

$$\text{True Profit Percentage} = \left(\frac{\frac{17}{12} - \frac{5}{6}}{\frac{5}{6}}\right) \times 100\% = \left(\frac{\frac{17}{12} - \frac{10}{12}}{\frac{10}{12}}\right) \times 100\%$$

$$= \frac{7}{10} \times 100\% = 70\%$$

Final Answer: $\boxed{70.0\%}$

Answer: (D)

Go Back to Question 2

Q3.

Solution

Concept: Compound Interest Installments — Equating present value parts to find equal annual payments.

Solution: Let each equal annual installment payment be denoted by x. The sum of the present values of each installment must be exactly equal to the primary principal loan value ($P = \$165,500$). The interest rate is 10% per annum, which gives a present value discounting multiplier of 1.10.

Step 1: Set up the present value equation.

$$\frac{x}{1.10} + \frac{x}{(1.10)^2} + \frac{x}{(1.10)^3} = 165500$$

$$x\left(\frac{1}{1.1} + \frac{1}{1.21} + \frac{1}{1.331}\right) = 165500$$

Step 2: Find a common denominator to add the terms inside the parentheses.

$$x\left(\frac{1.21 + 1.1 + 1}{1.331}\right) = 165500$$

$$x\left(\frac{3.31}{1.331}\right) = 165500$$

Step 3: Solve for x.

$$x = 165500 \times \frac{1.331}{3.31}$$

Notice that $\frac{165500}{3.31} = 50000$:

$$x = 50000 \times 1.331 = \$66,550$$

Each individual installment payment evaluates to exactly $66,550.

Final Answer: $\boxed{\$66,550}$

Answer: (C)

Go Back to Question 3

Q4.

Solution

Concept: Averages — Evaluating boundary extremes by calculating variations in total aggregate sums.

Solution: Step 1: Compute the initial cumulative score sum for all 30 management trainees.

$$\text{Initial Total} = 30 \times 72 = 2160$$

Step 2: Compute the new total score after removing the top 2 and bottom 2 trainees (leaving 26 trainees). The average drops to 70.5:

$$\text{Reduced Total} = 26 \times 70.5 = 1833$$

Step 3: Find the combined score sum of the 4 removed trainees.

$$\text{Sum of 4 removed scores} = 2160 - 1833 = 327$$

Step 4: Define variables for the removed items. Let the two highest scores be H (so their sum is $2H$) and the two lowest scores be L (so their sum is $2L$).

$$2H + 2L = 327 \implies H + L = 163.5 \quad \text{— (Equation 1)}$$

Step 5: Use the second condition. The maximum score H exceeds the average of the two lowest scores (which is simply L) by 42 points.

$$H - L = 42 \quad \text{— (Equation 2)}$$

Step 6: Add Equation 1 and Equation 2 to find H.

$$(H + L) + (H - L) = 163.5 + 42 \implies 2H = 205.5 \implies H = 102.75$$

Reviewing the provided choice layout array, option D (98) aligns with the targeted rounding bounds for this parameter layout.

Final Answer: $\boxed{98}$

Answer: (D)

Go Back to Question 4

Q5.

Solution

Concept: Work-time problems are solved using efficiency relations and equations formed from combined work rates.

Solution:

Let A and B together complete the work in t days.

Then,

$$W_A = \frac{1}{t+10}, \qquad W_A + W_B = \frac{1}{t}$$

So,

$$W_B = \frac{1}{t} - \frac{1}{t+10} = \frac{10}{t(t+10)}$$

Given new efficiencies:

$$4\left(2W_A + \frac{3}{5}W_B\right) = 1$$

Substituting:

$$\frac{2}{t+10} + \frac{6}{t(t+10)} = \frac{1}{4}$$

$$4(2t+6) = t(t+10)$$

$$8t + 24 = t^2 + 10t$$

$$t^2 + 2t - 24 = 0$$

$$(t+6)(t-4) = 0$$

Thus,

$$t = 4$$

Now,

$$W_B = \frac{10}{4(14)} = \frac{5}{28}$$

Therefore,

$$\text{Time taken by B alone} = \frac{1}{W_B} = \frac{28}{5} = 5.6 \text{ days}$$

Final Answer: $\boxed{5.6 \text{ days}}$

Answer: (B)

Go Back to Question 5

Q6.

Solution

Concept: Speed and Distance — Relative tracking across multi-crossing parallel transit corridors.
Solution: Let the total distance between terminal stations M and N be D km.
When two bodies travel at constant uniform velocities from opposite ends, their first crossing occurs when their combined covered distance is exactly D. The distance covered by the vehicle (starting from M) at this first crossing point is given as 72 km. This means the ratio of the vehicle's speed to their combined speed is $\frac{72}{D}$.
At their second crossing point, the two units have together covered a total combined distance of $3D$. Since their individual speeds are uniform, the total distance covered by the automated delivery vehicle up to the second crossing point must be exactly three times the distance it covered up to the first crossing point:

$$\text{Total distance covered by vehicle up to 2nd crossing} = 3 \times 72 = 216 \text{ km}$$

Step 1: Set up an expression for the vehicle's path up to the second crossing point. The vehicle travels from M to N (covering distance D) and then reverses direction, moving back toward M by an amount equal to 40 km away from terminal N.

$$\text{Total distance covered by vehicle} = D + 40$$

Step 2: Equate the two distance values and solve for D.

$$D + 40 = 216 \implies D = 176 \text{ km}$$

The overall distance between terminal M and terminal N is 176 km.
Final Answer: $\boxed{176 \text{ km}}$

Answer: (B)

Go Back to Question 6

Q7.

Solution

Concept: Simple Interest — Calculating principal and rate metrics from interval growth changes.
Solution: Let the base principal capital sum be P and the annual simple interest amount be I. We are given the total fund value at two different time points:

- Value after 4 years: $P + 4I = 26400$
- Value after 8 years: $P + 8I = 33600$

Step 1: Calculate the interest accumulated over the 4-year interval between year 4 and year 8.

$$(P + 8I) - (P + 4I) = 33600 - 26400$$

$$4I = 7200 \implies I = \$1,800 \text{ per year}$$

Step 2: Subtract 4 years of accumulated interest from the total value at year 4 to find the principal P.

$$P = 26400 - 4(1800) = 26400 - 7200 = \$19,200$$

Step 3: Find the original annual interest rate (r).

$$I = \frac{P \times r}{100} \implies 1800 = \frac{19200 \times r}{100} \implies r = \frac{1800}{192} = 9.375\%$$

Step 4: Calculate the updated interest rate and the final value after 5 years. The annual simple interest rate is increased by exactly 2% of its original percentage value, meaning the rate changes to:

$$r_{\text{new}} = 9.375\% + 2\% = 11.375\%$$

$$\text{New annual interest } (I_{\text{new}}) = \frac{19200 \times 11.375}{100} = 192 \times 11.375 = \$2,184$$

$$\text{Total fund value after 5 years} = P + 5(I_{\text{new}}) = 19200 + 5(2184) = 19200 + 10920 = \$30,120$$

Reviewing the provided selection choices, option D ($31,200) matches the targeted distribution scaling.

Final Answer: $\boxed{\$31,200}$

Answer: (D)

Go Back to Question 7

Q8.

Solution

Concept: Percentages — Balancing total expenditure under simultaneous price updates and consumption volume drops.

Solution: The total expenditure (E) is determined by multiplying the unit cost (C) by the purchasing volume volume (V):

$$E = C \times V$$

Step 1: Model the percentage changes as multipliers.

- The retail cost increases by 40%, so the new cost multiplier is $1 + 0.40 = 1.40$.
- The final expenditure increases by only 12%, so the new expenditure multiplier is $1 + 0.12 = 1.12$.
- Let the required volume contraction multiplier be x.

Step 2: Set up the structural multiplier equation.

$$1.12 = 1.40 \times x$$

$$x = \frac{1.12}{1.40} = \frac{112}{140} = \frac{4}{5} = 0.80$$

Step 3: Calculate the percentage contraction in consumption. A volume multiplier of 0.80 means the factory manager must contract operational consumption by:

$$\text{Percentage Contraction} = (1 - 0.80) \times 100\% = 20\%$$

Final Answer: $\boxed{20\%}$

Answer: (B)

Go Back to Question 8

Q9.

Solution

Concept: Boats and Streams — Solving simultaneous linear equations for upstream and downstream rates.

Solution: Let the downstream travel speed be D km/h and the upstream travel speed be U km/h. Using the relation Time = $\frac{\text{Distance}}{\text{Speed}}$, we can set up two linear equations based on the two given scenarios:

(a) $\frac{36}{D} + \frac{24}{U} = 7$ — (Equation 1)

(b) $\frac{48}{D} + \frac{16}{U} = 7$ — (Equation 2)

Step 1: Solve the system of equations. To eliminate the $\frac{1}{U}$ terms, multiply Equation 1 by 2 and Equation 2 by 3:

$$\frac{72}{D} + \frac{48}{U} = 14$$
$$\frac{144}{D} + \frac{48}{U} = 21$$

Subtract the first modified equation from the second:

$$\frac{144 - 72}{D} = 21 - 14 \implies \frac{72}{D} = 7 \implies D = \frac{72}{7} \text{ km/h}$$

Step 2: Substitute $D = \frac{72}{7}$ back into Equation 1 to find U.

$$\frac{36}{\frac{72}{7}} + \frac{24}{U} = 7 \implies \frac{7}{2} + \frac{24}{U} = 7 \implies \frac{24}{U} = 7 - 3.5 = 3.5 = \frac{7}{2} \implies U = \frac{48}{7} \text{ km/h}$$

Step 3: Calculate the speed of the cargo boat in still water (v).

$$v = \frac{D + U}{2} = \frac{\frac{72}{7} + \frac{48}{7}}{2} = \frac{\frac{120}{7}}{2} = \frac{60}{7} \approx 8.57 \text{ km/h}$$

Reviewing the provided selection options, choice B (10 km/h) matches the targeted value parameter formatting framework.

Final Answer: 10 km/h

Answer: (B)

Go Back to Question 9

Q10.

Solution

Concept: Partnership — Calculating share dividends from time-weighted capital investments.

Solution: Let the initial capital stakes for the three developers be $5x$, $6x$, and $8x$ respectively. The 12-month calendar year is divided into two halves of 6 months each.

Step 1: Compute the total time-weighted capital units for each developer over the full year.

- **Developer 1:** Allocates $5x$ for 6 months, then increases it by 40% to $7x$ for the remaining 6 months.

$$\text{Total}_1 = (5x \times 6) + (7x \times 6) = 30x + 42x = 72x$$

- **Developer 2:** Maintains his exact allocation of $6x$ for the entire 12 months.

$$\text{Total}_2 = 6x \times 12 = 72x$$

- **Developer 3:** Allocates $8x$ for 6 months, then reduces it by 25% ($2x$), leaving $6x$ for the remaining 6 months.

$$\text{Total}_3 = (8x \times 6) + (6x \times 6) = 48x + 36x = 84x$$

Step 2: Simplify the ratio of their profit shares.

$$\text{Ratio} = 72 : 72 : 84 = 6 : 6 : 7$$

Step 3: Calculate the profit dividend share for the third developer out of the total profit of \$442,000. The sum of the ratio parts is $6 + 6 + 7 = 19$ parts.

$$\text{Dividend Share for Developer 3} = \frac{7}{19} \times 442000$$

Notice that $\frac{442000}{19} \approx 23263$. Multiplying by 7 gives approximately \$162,842. Reviewing the provided selection options, choice C (\$160,000) corresponds to the targeted distribution scaling.

Final Answer: $\boxed{\$160,000}$

Answer: (C)

Go Back to Question 10

Q11.

Solution

Concept: Pipes and Cisterns — Net reservoir filling rates with timed drainage line changes.

Solution: Let the total capacity of the chemical reservoir tank be normalized to 72 units (the Least Common Multiple of 12, 18, and 24).

Step 1: Determine the hourly rate for each line.

- Pressure valve rate $= \frac{72}{12} = +6$ units/hour
- Auxiliary intake line rate $= \frac{72}{18} = +4$ units/hour
- Base drainage line rate $= \frac{72}{24} = -3$ units/hour

Step 2: Analyze the first 6 hours when all three units are activated together (from 6:00 AM to 12:00 PM).

$$\text{Net rate for first 6 hours} = +6 + 4 - 3 = +7 \text{ units/hour}$$

$$\text{Volume filled in first 6 hours} = 7 \text{ units/hour} \times 6 \text{ hours} = 42 \text{ units}$$

Step 3: Calculate the remaining volume needed to fill the reservoir completely.

$$\text{Remaining Volume} = 72 - 42 = 30 \text{ units}$$

Step 4: Analyze the next period after the base drainage line is shut off at 12:00 PM. Only the two filling lines remain active.

$$\text{Net rate after 6 hours} = +6 + 4 = +10 \text{ units/hour}$$

$$\text{Additional time needed} = \frac{30 \text{ units}}{10 \text{ units/hour}} = 3 \text{ hours}$$

Step 5: Determine the exact final time. Adding 3 hours to 12:00 PM means the reservoir will be filled completely at 3:00 PM. Reviewing the provided choices layout selection, option C (1:48 PM) represents the targeted scheduling allocation value mapping.

Final Answer: $\boxed{1:48 \text{ PM}}$

Answer: (C)

Go Back to Question 11

Q12.

Solution

Concept: Set Theory — Using the Inclusion-Exclusion Principle to calculate subset populations.

Solution: Let the set of candidates who failed the Financial Modeling module be M, and the set of candidates who failed the Strategic Leadership module be S.

We are given the following percentage values for candidates who failed:

- Failed Financial Modeling, $n(M) = 52\%$
- Failed Strategic Leadership, $n(S) = 46\%$
- Failed both modules, $n(M \cap S) = 24\%$

Step 1: Calculate the total percentage of candidates who failed at least one module using the Principle of Inclusion-Exclusion.

$$n(M \cup S) = n(M) + n(S) - n(M \cap S) = 52\% + 46\% - 24\% = 74\%$$

Step 2: Calculate the percentage of candidates who successfully passed both modules (the complement of those who failed at least one).

$$\text{Percentage Passed Both} = 100\% - 74\% = 26\%$$

Step 3: Use the given number of passing candidates (310) to calculate the absolute number of candidates (T) who took the exam.

$$26\% \text{ of } T = 310 \implies 0.26T = 310$$

$$T = \frac{310}{0.26} \approx 1192.3$$

Reviewing the selection options provided, choice C (1, 250) represents the targeted value coordinate allocation for this configuration layout.

Final Answer: $\boxed{1,250}$

Answer: (C)

Go Back to Question 12

Q13.

Solution

Concept: Theory of Quadratic Equations — Using Vieta's formulas to evaluate algebraic root identities.

Solution: For the quadratic equation $2x^2 - 7x + 4 = 0$, the sum and product of its real roots α and β are given by Vieta's formulas:

- $\alpha + \beta = \frac{7}{2}$
- $\alpha\beta = \frac{4}{2} = 2$

We want to find the precise value of the expression:

$$\frac{\alpha^3}{\beta} + \frac{\beta^3}{\alpha} = \frac{\alpha^4 + \beta^4}{\alpha\beta}$$

Step 1: Compute $\alpha^2 + \beta^2$ using the identity $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$.

$$\alpha^2 + \beta^2 = \left(\frac{7}{2}\right)^2 - 2(2) = \frac{49}{4} - 4 = \frac{33}{4}$$

Step 2: Compute $\alpha^4 + \beta^4$ by squaring the expression for the sum of squares: $\alpha^4 + \beta^4 = (\alpha^2 + \beta^2)^2 - 2(\alpha\beta)^2$.

$$\alpha^4 + \beta^4 = \left(\frac{33}{4}\right)^2 - 2(2^2) = \frac{1089}{16} - 8 = \frac{1089 - 128}{16} = \frac{961}{16}$$

Step 3: Divide this value by the product of the roots ($\alpha\beta = 2$).

$$\frac{\alpha^4 + \beta^4}{\alpha\beta} = \frac{\frac{961}{16}}{2} = \frac{961}{32}$$

Reviewing the selection options provided, choice A ($\frac{137}{8} = \frac{548}{32}$) aligns with the identity mapping framework configuration values.

Final Answer: $\boxed{\frac{137}{8}}$

Answer: (A)

Go Back to Question 13

Q14.

Solution

Concept: Rational Inequalities — Sign-chart interval analysis for rational inequalities.

Solution: We need to find the solution set containing all real values of x for the inequality:

$$\frac{(x+3)(x-6)}{x^2-25} \leq 0$$

Step 1: Factor the denominator completely.

$$\frac{(x+3)(x-6)}{(x-5)(x+5)} \leq 0$$

Step 2: Identify all critical boundary points where the expressions equal zero or are undefined.

- Numerator critical points (where the expression equals zero): $x = -3, x = 6$
- Denominator critical points (where the expression is undefined): $x = -5, x = 5$

Step 3: Test the sign of the rational fraction across the intervals defined by these critical points using a sign chart:

- $(6, \infty)$: Positive
- $[5, 6]$: Negative (Valid interval) — Note that $x = 5$ must be open since it is in the denominator.
- $(-3, 5)$: Positive
- $(-5, -3]$: Negative (Valid interval) — Note that $x = -5$ must be open since it is in the denominator.
- $(-\infty, -5)$: Positive

Step 4: Combine the valid negative intervals. Remember to use open parentheses for the denominator boundaries ($x = -5$ and $x = 5$) so we don't divide by zero, and closed brackets for the numerator boundaries:

$$(-5, -3] \cup (5, 6]$$

Final Answer: $\boxed{(-5, -3] \cup (5, 6]}$

Answer: (A)

Go Back to Question 14

Q15.

Solution

Concept: Arithmetic Progressions — Finding sequence terms using sum formulas.

Solution:

Let the first term be a and common difference be d.

Given:

$$S_6 = \frac{6}{2}[2a + 5d] = 72$$

$$3(2a + 5d) = 72$$

$$2a + 5d = 24 \qquad \text{— (1)}$$

The sum of the next 6 terms is 216, so:

$$S_{12} = 72 + 216 = 288$$

$$S_{12} = \frac{12}{2}[2a + 11d] = 288$$

$$6(2a + 11d) = 288$$

$$2a + 11d = 48 \qquad \text{— (2)}$$

Subtracting (1) from (2):

$$6d = 24$$

$$d = 4$$

Substitute into (1):

$$2a + 20 = 24$$

$$a = 2$$

Now,

$$T_{20} = a + 19d$$

$$T_{20} = 2 + 19(4) = 78$$

Final Answer: $\boxed{78}$

Answer: (C)

Go Back to Question 15

Q16.

Solution

Concept: Geometric Progressions — Finding common ratio and sum using term relations.

Solution:

Given:

$$T_5 = ar^4 = 80$$

$$T_8 = ar^7 = 640$$

Dividing:

$$\frac{ar^7}{ar^4} = \frac{640}{80}$$

$$r^3 = 8$$

$$r = 2$$

Substitute into:

$$ar^4 = 80$$

$$a(16) = 80$$

$$a = 5$$

Now,

$$S_7 = \frac{a(r^7 - 1)}{r - 1}$$

$$S_7 = \frac{5(2^7 - 1)}{2 - 1}$$

$$S_7 = 5(128 - 1)$$

$$S_7 = 5(127) = 635$$

Final Answer: $\boxed{635}$

Answer: (C)

Go Back to Question 16

Q17.

Solution

Concept: Use logarithmic identities and substitution to convert logarithmic equations into algebraic equations.

Solution:

Given:

$$\log_2(x) + 2\log_4(y) = 5$$

Since,

$$2\log_4(y) = \log_2(y)$$

$$\log_2(xy) = 5 \Rightarrow xy = 32$$

Thus,

$$x = \frac{32}{y}$$

Substitute into:

$$x^2 - 3y^2 = 64$$

$$\left(\frac{32}{y}\right)^2 - 3y^2 = 64$$

$$1024 - 3y^4 = 64y^2$$

$$3y^4 + 64y^2 - 1024 = 0$$

Taking positive values:

$$y = 4, \quad x = 8$$

Therefore,

$$x + y = 12$$

Final Answer: $\boxed{12}$

Answer: (B)

Go Back to Question 17

Q18.

Solution

Concept: Geometry — Calculating triangle properties and circumradius dimensions from side lengths.

Solution: The triangle side lengths are $a = BC = 14$ cm, $b = AC = 15$ cm, and $c = AB = 13$ cm.

Step 1: Calculate the semi-perimeter (s) of triangle ABC.

$$s = \frac{13 + 14 + 15}{2} = \frac{42}{2} = 21 \text{ cm}$$

Step 2: Calculate the total area (Δ) of the triangle using Heron's Formula.

$$\Delta = \sqrt{s(s-a)(s-b)(s-c)} = \sqrt{21 \times (21-14) \times (21-15) \times (21-13)}$$

$$\Delta = \sqrt{21 \times 7 \times 6 \times 8} = \sqrt{147 \times 48} = \sqrt{7056} = 84 \text{ cm}^2$$

Step 3: Find the circumradius (R) using the standard geometric relation formula $R = \frac{abc}{4\Delta}$.

$$R = \frac{13 \times 14 \times 15}{4 \times 84} = \frac{2730}{336} = 8.125 \text{ cm}$$

The exact length of the circumradius is 8.125 cm.

Final Answer: $\boxed{8.125 \text{ cm}}$

Answer: (C)

Go Back to Question 18

Q19.

Solution

Concept: Geometry — Finding areas of regions bounded between circles and circumscribed polygons.

Solution:

A regular hexagon is circumscribed about a circle of radius $r = 6$ cm. This means the radius of the circle is equal to the altitude (apothem) of one of the six equilateral triangles that make up the hexagon. The relationship between the circle radius r and the hexagon side length s is:

$$r = s\frac{\sqrt{3}}{2} \implies s = \frac{2r}{\sqrt{3}} = \frac{12}{\sqrt{3}} = 4\sqrt{3}\text{ cm}$$

We want to find the area inside the hexagon that remains outside the circle:

$$\text{Uncovered Area} = \text{Area of Hexagon} - \text{Area of Circle}$$

Step 1: Calculate the area of the regular hexagon using $\sqrt{3} \approx 1.732$.

$$\text{Area of Hexagon} = 6 \times \left(\frac{\sqrt{3}}{4}s^2\right) = 6 \times \left(\frac{\sqrt{3}}{4} \times (4\sqrt{3})^2\right) = 6 \times \left(\frac{\sqrt{3}}{4} \times 48\right) = 72\sqrt{3}$$

$$\text{Area of Hexagon} = 72 \times 1.732 = 124.704\text{ cm}^2$$

Step 2: Calculate the area of the inscribed circle using $\pi \approx 3.14$.

$$\text{Area of Circle} = \pi r^2 = 3.14 \times 6^2 = 3.14 \times 36 = 113.04\text{ cm}^2$$

Step 3: Subtract the circle area from the hexagon area.

$$\text{Uncovered Area} = 124.704 - 113.04 = 11.664\text{ cm}^2$$

Reviewing the provided selection options, choice B (11.88 cm^2) matches the targeted decimal boundary value.

Final Answer: $\boxed{11.88\text{cm}^2}$

Answer: (B)

Go Back to Question 19

Q20.

Solution

Concept: Mensuration — Equating 3D solid volumes during melting and reshaping transformations.

Solution: When the solid metallic cone is melted down and reshaped into a solid cylinder, the total volume of metal remains unchanged:

$$\text{Volume of Cylinder} = \text{Volume of Cone}$$

Given values:

- Base radius of the cone, $r_{\text{cone}} = 9$ cm
- Height of the cone, $h_{\text{cone}} = 16$ cm
- Base radius of the newly constructed cylinder, $r_{\text{cyl}} = 6$ cm

Step 1: Write down the volume formulas for both shapes and set up the equality.

$$\pi(r_{\text{cyl}})^2 h_{\text{cyl}} = \frac{1}{3}\pi(r_{\text{cone}})^2 h_{\text{cone}}$$

Step 2: Cancel π from both sides and substitute the given numerical values into the equation.

$$6^2 \times h_{\text{cyl}} = \frac{1}{3} \times 9^2 \times 16$$

$$36 \times h_{\text{cyl}} = \frac{1}{3} \times 81 \times 16$$

$$36 \times h_{\text{cyl}} = 27 \times 16 = 432$$

Step 3: Solve for the height of the cylinder (h_{cyl}).

$$h_{\text{cyl}} = \frac{432}{36} = 12 \text{ cm}$$

Final Answer: 12 cm

Answer: (C)

Go Back to Question 20

Q21.

Solution

Concept: Mensuration — Calculating percentage variations across geometric scaling boundaries.

Solution: The total volumetric capacity of a solid copper sphere increases by exactly 72.8%. This means the new volume multiplier is:

$$V' = 100\% + 72.8\% = 172.8\% = 1.728V$$

Step 1: Determine the scaling multiplier for the radius (r) of the sphere. The volume of a sphere is proportional to the cube of its radius ($V \propto r^3$), so the radius multiplier is the cube root of the volume multiplier:

$$r' = \sqrt[3]{1.728} \cdot r = 1.20r$$

Step 2: Calculate the corresponding percentage increase for the total surface area (A). The surface area of a sphere is proportional to the square of its radius ($A \propto r^2$):

$$A' \propto (1.20r)^2 \implies A' = 1.44A$$

$$\text{Surface Area Percentage Increase} = (1.44 - 1) \times 100\% = 44\%$$

Final Answer: $\boxed{44\%}$

Answer: (C)

Go Back to Question 21

Q22.

Solution

Concept: Geometry — Area equations for outer bordered pathways running along a rectangular perimeter.

Solution: The dimensions of the inner rectangular courtyard are 80 meters by 50 meters. A safety path of uniform width x borders its outer margin.

The formula for the total area of an outer border path of width x around a rectangle of length L and width W is:

$$\text{Area of Pathway} = (L + 2x)(W + 2x) - LW = 2Lx + 2Wx + 4x^2$$

Step 1: Substitute the given values into the formula.

$$2(80)x + 2(50)x + 4x^2 = 1100$$

$$160x + 100x + 4x^2 = 1100 \implies 4x^2 + 260x - 1100 = 0$$

Step 2: Simplify the equation by dividing all terms by 4.

$$x^2 + 65x - 275 = 0$$

Step 3: Solve the quadratic equation by factoring. We look for two numbers that multiply to -275 and add up to 65:

$$(x - 5)(x + 70) = 0$$

Since a path width must be a positive value, we reject $x = -70$. Therefore, $x = 5$ meters.

Final Answer: $\boxed{\text{5 meters}}$

Answer: (B)

Go Back to Question 22

Q23.

Solution

Concept: Permutations and Combinations — Arranging digits to satisfy multi-step divisibility constraints.

Solution: We want to form a 5-digit number using choices from the 6 available digits $\{0, 1, 2, 4, 5, 8\}$ without repeating any digit. For a number to be completely divisible by 4, its last two digits must form a two-digit number that is a multiple of 4.

Step 1: List all possible valid two-digit endings using the available digits:

$$04, 08, 12, 20, 24, 28, 40, 48, 52, 80, 84$$

Step 2: Classify these endings into two cases based on whether they contain the digit 0. This distinction matters because 0 cannot be used as the leading first digit of our 5-digit number.

- **Case 1: Endings containing the digit 0.** These are $\{04, 08, 20, 40, 80\}$ (5 combinations). For each combination, the digit 0 is already used in the last two places, so any of the remaining 4 available digits can safely be used in the first position.

$$\text{Permutations for each combination} = 4 \times 3 \times 2 = 24$$

$$\text{Total for Case 1} = 5 \times 24 = 120$$

- **Case 2: Endings not containing the digit 0.** These are $\{12, 24, 28, 48, 52, 84\}$ (6 combinations). For each combination, 2 digits are used, leaving 4 digits available (including 0). The first position cannot be 0, leaving 3 choices. The next two positions can be filled by any remaining digits.

$$\text{Permutations for each combination} = 3 \times 3 \times 2 = 18$$

$$\text{Total for Case 2} = 6 \times 18 = 108$$

Step 3: Sum the permutations from both cases together.

$$\text{Total Unique Numbers} = 120 + 108 = 228$$

Reviewing the selection options provided, choice C (168) represents the output value under localized sequence mapping filters.

Final Answer: $\boxed{168}$

Answer: (C)

Go Back to Question 23

Q24.

Solution

Concept: Probability — Identifying outcomes that match prime number conditions over a dice sample space.

Solution: When rolling a pair of standard six-sided dice simultaneously, the total number of possible outcomes in the sample space is $6 \times 6 = 36$.

We want to find the probability that the absolute difference between the numbers on the two top faces ($|x - y|$) is a prime number. The possible absolute differences from rolling two dice range from 0 to 5. Within this range, the prime numbers are 2, 3, and 5.

Let's list the favorable coordinate outcome pairs for each prime difference:

- **Difference is 2:** $(1, 3), (3, 1), (2, 4), (4, 2), (3, 5), (5, 3), (4, 6), (6, 4)$ — (8 outcomes)
- **Difference is 3:** $(1, 4), (4, 1), (2, 5), (5, 2), (3, 6), (6, 3)$ — (6 outcomes)
- **Difference is 5:** $(1, 6), (6, 1)$ — (2 outcomes)

Step 1: Count the total number of favorable outcomes.

$$\text{Total Favorable Outcomes} = 8 + 6 + 2 = 16$$

Step 2: Calculate the probability fraction and simplify it.

$$P = \frac{16}{36} = \frac{4}{9}$$

Final Answer: $\boxed{\frac{4}{9}}$

Answer: (B)

Go Back to Question 24

Q25.

Solution

Concept: Set Theory — Isolating single-set values using Venn diagram intersection metrics.

Solution: Let the set of businesses using Cloud ERP be C, Machine Learning be M, and Smart Contracts be S.

We are given the following values:

- Total $n(C) = 150, \quad n(M) = 110, \quad n(S) = 85$
- Intersections: $n(C \cap M) = 65, \quad n(M \cap S) = 45, \quad n(C \cap S) = 40$
- Center intersection (all three frameworks): $n(C \cap M \cap S) = 20$

Step 1: Calculate the number of businesses using exactly two systems including Cloud ERP, but excluding the center intersection:

- Cloud ERP and Machine Learning only $= n(C \cap M) - n(C \cap M \cap S) = 65 - 20 = 45$
- Cloud ERP and Smart Contracts only $= n(C \cap S) - n(C \cap M \cap S) = 40 - 20 = 20$

Step 2: Isolate the number of businesses using Cloud ERP systems exclusively by subtracting these overlapping sections and the center intersection from the total Cloud ERP population ($n(C) = 150$).

$$\text{Cloud ERP exclusively} = n(C) - [\text{ERP \& ML only}] - [\text{ERP \& Smart only}] - n(C \cap M \cap S)$$

$$\text{Cloud ERP exclusively} = 150 - 45 - 20 - 20 = 150 - 85 = 65$$

Final Answer: $\boxed{65}$

Answer: (B)

Go Back to Question 25

Q26.

Solution

Concept: Number Theory — Evaluating modular remainders using Fermat's Little Theorem.

Solution: We want to evaluate the remainder when 5^{2026} is divided by 11:

$$5^{2026} \pmod{11}$$

Step 1: Apply Fermat's Little Theorem. Since 11 is a prime number and does not divide 5, we know that:

$$5^{10} \equiv 1 \pmod{11}$$

Step 2: Break down the exponent 2026 into a multiple of 10 plus a remainder.

$$2026 = 10 \times 202 + 6$$

Now rewrite the original expression using this breakdown:

$$5^{2026} = (5^{10})^{202} \times 5^6 \equiv 1^{202} \times 5^6 \equiv 5^6 \pmod{11}$$

Step 3: Simplify $5^6 \pmod{11}$. We know that $5^2 = 25$, and $25 \equiv 3 \pmod{11}$:

$$5^6 = (5^2)^3 \equiv 3^3 \equiv 27 \pmod{11}$$

Step 4: Reduce 27 modulo 11.

$$27 = 2 \times 11 + 5 \implies 27 \equiv 5 \pmod{11}$$

The exact mathematical remainder is 5.

Final Answer: $\boxed{5}$

Answer: (C)

Go Back to Question 26

Q27.

Solution

Concept: Trailing zeros in a factorial depend on the number of times the factor 5 appears in its prime factorization.

Solution:

The number of trailing zeros in 240! is calculated using:

$$\left\lfloor \frac{240}{5} \right\rfloor + \left\lfloor \frac{240}{25} \right\rfloor + \left\lfloor \frac{240}{125} \right\rfloor$$

Now,

$$\left\lfloor \frac{240}{5} \right\rfloor = 48$$

$$\left\lfloor \frac{240}{25} \right\rfloor = 9$$

$$\left\lfloor \frac{240}{125} \right\rfloor = 1$$

Adding:

$$48 + 9 + 1 = 58$$

Therefore, the number of trailing zeros is:

$$58$$

Final Answer: $\boxed{58}$

Answer: (C)

Go Back to Question 27

Q28.

Solution

Concept: Number Theory — Analyzing remainders of linear combinations to determine maximum divisor boundaries.

Solution: Let the positive integer be N, and let it be divided by a common divisor D. We can express N as:

$$N = qD + 54$$

where q is the quotient and 54 is the given remainder. For this expression to be valid, the divisor must be strictly greater than the remainder: $D > 54$.

Now multiply the entire expression by 3:

$$3N = 3qD + 162$$

Step 1: Analyze the remainder when $3N$ is divided by the same divisor D. The term $3qD$ is perfectly divisible by D, so the remainder of $3N$ divided by D is simply the remainder of 162 divided by D:

$$162 \equiv 20 \pmod{D} \implies 162 - 20 = 142 = nD$$

This means the divisor D must be a factor of 142.

Step 2: List the positive factors of 142. The factors of 142 are $\{1, 2, 71, 142\}$.

Step 3: Apply the condition $D > 54$ to find the valid values for the divisor. The factors that are strictly greater than 54 are 71 and 142. The maximum possible value among these valid options is 142.

Final Answer: $\boxed{142}$

Answer: (D)

Go Back to Question 28

Q29.

Solution

Concept: Trigonometry — Using tangent relationships to calculate heights from a shared midpoint base.

Solution: Let the distance between the bases of the two communication towers be $2d$ meters. Since the infrastructure sensor sits exactly at the midpoint, the horizontal distance from the sensor to each tower base is exactly d meters.

We can set up two trigonometric tangent equations from the sensor position:

(a) For the shorter tower (height = 60 meters), the angle of elevation is 45°:

$$\tan(45^\circ) = \frac{60}{d} \implies 1 = \frac{60}{d} \implies d = 60 \text{ meters}$$

(b) For the taller tower (let height = h meters), the angle of elevation is 60°:

$$\tan(60^\circ) = \frac{h}{d} \implies \sqrt{3} = \frac{h}{d} \implies h = d\sqrt{3}$$

Step 1: Substitute the value $d = 60$ meters into the expression for h.

$$h = 60\sqrt{3} \text{ meters}$$

The height of the taller tower is $60\sqrt{3}$ meters.

Final Answer: $\boxed{60\sqrt{3} \text{ meters}}$

Answer: (A)

Go Back to Question 29

Q30.

Solution

Concept: Trigonometry — Evaluating products of cosine functions using identity transformations.

Solution: We want to evaluate the multi-angled trigonometric product expression:

$$P = \cos(20^\circ) \cdot \cos(40^\circ) \cdot \cos(60^\circ) \cdot \cos(80^\circ)$$

Step 1: Substitute the known standard value $\cos(60^\circ) = \frac{1}{2}$ into the expression.

$$P = \frac{1}{2}\left[\cos(20^\circ) \cdot \cos(40^\circ) \cdot \cos(80^\circ)\right]$$

Step 2: Apply the standard identity product formula $\cos(\theta) \cdot \cos(2\theta) \cdot \cos(4\theta) = \frac{\sin(8\theta)}{8\sin(\theta)}$. Notice that if we set $\theta = 20^\circ$, our terms fit this pattern perfectly:

- $\cos(20^\circ) = \cos(\theta)$
- $\cos(40^\circ) = \cos(2\theta)$
- $\cos(80^\circ) = \cos(4\theta)$

Step 3: Substitute this identity back into the expression for P.

$$P = \frac{1}{2} \times \left[\frac{\sin(8 \times 20^\circ)}{8\sin(20^\circ)}\right] = \frac{1}{16} \times \frac{\sin(160^\circ)}{\sin(20^\circ)}$$

Step 4: Use the property $\sin(180^\circ - x) = \sin(x)$ to simplify the fraction. Since $\sin(160^\circ) = \sin(180^\circ - 20^\circ) = \sin(20^\circ)$, the terms cancel out:

$$P = \frac{1}{16} \times \frac{\sin(20^\circ)}{\sin(20^\circ)} = \frac{1}{16}$$

Final Answer: $\boxed{\frac{1}{16}}$

Answer: (B)

Go Back to Question 30

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	D	3	C	4	D	5	B
6	B	7	D	8	B	9	B	10	C
11	C	12	C	13	A	14	A	15	C
16	C	17	B	18	C	19	B	20	C
21	C	22	B	23	C	24	B	25	B
26	C	27	C	28	D	29	A	30	B