

SSC CPO Previous Year Question Paper 2017

Quantitative Aptitude (Questions and Solutions)

Q. (1) If $1/N = (\sqrt{6} + \sqrt{5}) / (\sqrt{6} - \sqrt{5})$, then what is the value of N?

1. $6 - \sqrt{30}$
2. $6 + \sqrt{30}$
3. $11 - 2\sqrt{30}$
4. $11 + 2\sqrt{5}$

Answer: 3 ($11 - 2\sqrt{30}$)

Solution:

$$\begin{aligned}1/N &= (\sqrt{6} + \sqrt{5}) / (\sqrt{6} - \sqrt{5}) \\ \Rightarrow N &= (\sqrt{6} - \sqrt{5}) / (\sqrt{6} + \sqrt{5}) \\ \Rightarrow N \times [(\sqrt{6} + \sqrt{5})(\sqrt{6} - \sqrt{5})] &= [(\sqrt{6} - \sqrt{5}) / (\sqrt{6} + \sqrt{5})] \times [(\sqrt{6} + \sqrt{5})(\sqrt{6} - \sqrt{5})] \\ \Rightarrow N \times [(\sqrt{6})^2 - (\sqrt{5})^2] &= (\sqrt{6} - \sqrt{5})^2 \text{ [Since, } (a + b)(a - b) = a^2 - b^2\text{]} \\ \Rightarrow N \times (6 - 5) &= (\sqrt{6})^2 - 2 \cdot \sqrt{6} \cdot \sqrt{5} + (\sqrt{5})^2 \\ \Rightarrow N &= 11 - 2\sqrt{30}\end{aligned}$$

Q. (2) What is the value of the positive square root of $69 + 28\sqrt{5}$?

1. $7 + 2\sqrt{5}$
2. $7 - 2\sqrt{5}$
3. $2 + 7\sqrt{5}$
4. $2 - 7\sqrt{5}$

Answer: 1 ($7 + 2\sqrt{5}$)

$$\begin{aligned}\text{Solution: } &\sqrt{69 + 28\sqrt{5}} \\ &= \sqrt{69 + 2 \cdot 7 \cdot 2\sqrt{5}} \\ &= \sqrt{(7 \times 7) + 2 \cdot 7 \cdot 2\sqrt{5} + (25 \times 25)} \\ &= \sqrt{(7 + 2\sqrt{5}) \times (7 + 2\sqrt{5})} \\ &= 7 + 2\sqrt{5}\end{aligned}$$

Q. (3) $3^{11} + 3^{12} + 3^{13} + 3^{14}$ is divisible by _____.

1. 7
2. 8
3. 11
4. 14

Answer: 2

Solution: $3^{11} + 3^{12} + 3^{13} + 3^{14}$

$$= 3^{11} (1 + 3 + 3^2 + 3^3)$$

$$= 3^{11} \times 40$$

Since 40 is divisible by 8

Therefore, the above expression is also divisible by 8.

Q. (4) A boy added all natural numbers from 1 to 12, however, he added one number twice due to which the sum becomes 80. What is the number which he added twice?

1. 3
2. 2
3. 7
4. 8

Answer: 2

Solution: Upon adding all the natural numbers from 1 to 12, we get,

$$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 = 78$$

$$\text{Now, } 80 - 78 = 2$$

Hence, the number 2 is added twice.

Q. (5) What smallest value must be added to 508 so that the resultant is a perfect square?

1. 4
2. 9
3. 18
4. 21

Answer: 4

Solution:

We know that,

$$484 < 508 < 529$$

$$\Rightarrow (22)^2 < 508 < (23)^2$$

Thus, the smallest number to be added = $529 - 508 = 21$

Q. (6) Raman is 25% more efficient than Aman. If Aman can complete a piece of work in 25 days, then Raman can complete the same work in how many days?

1. 12
2. 15
3. 16
4. 20

Answer: 4

Solution: Let Aman's efficiency = 1 unit/day

Total work to be done = $1 \times 25 = 25$ units

Raman is 25% more efficient than Aman.

Therefore, Raman's efficiency = $1 \times (125/100) = 1.25$ units/day

\therefore Time taken by Raman working alone = $25/1.25 = 20$ days

Q. (7) A and B together can complete a work in 30 days. They started together but after 6 days A left the work and the work is completed by B after 36 more days. A alone can complete the entire work in how many days?

1. 45
2. 90
3. 60
4. 120

Answer: 2

Solution: Let work to be done = 180 units

Work done by A and B together in 1 day = $180/30 = 6$ units/day

Let the efficiency of B = y unit/day

According to the question,

$$(6 \times 6) + (36 \times y) = 180$$

$$\Rightarrow 36y = 180 - 36 = 144$$

$$\Rightarrow y = 144/36 = 4$$

Therefore, efficiency of A = $6 - 4 = 2$

Hence, time taken by A alone = $180/2 = 90$ days

Q. (8) The marked price of an article is 40% more than its cost price. If 10% discount is given, then what is the profit percentage?

1. 10
2. 20
3. 26
4. 32

Answer: 3

Solution: Let the cost price of the article = Rs. 100

Therefore, marked price = $100 + (40/100 \times 100)$

$$= 100 + 40$$

$$= \text{Rs. } 140$$

Given, discount = 10%

Hence, the selling price of the article = $140 - (10/100 \times 140)$

$$= 140 - 14$$

$$= \text{Rs. } 126$$

Therefore, profit % = $(126 - 100) / 100$

$$= 26\%$$

Q. (9) What will be the net discount (in per cent) after giving three successive discounts of 10%, 20% and 30%?

1. 50.4
2. 49.6
3. 45.3

4. 48.4

Answer: 2

Solution: Let the marked price be Rs. 100

Therefore, the selling price after a discount of 10% = $100 - (10/100 \times 100)$

$$= 100 - 10$$

$$= \text{Rs. } 90$$

Selling price after the second discount of 20% = $90 - (20/100 \times 90)$

$$= 90 - 18$$

$$= \text{Rs. } 72$$

Similarly, the selling price after the third discount of 30% = $72 - (30/100 \times 72)$

$$= 72 - 21.6$$

$$= \text{Rs. } 50.4$$

Therefore, net discount = $[(100 - 50.4) / 100] \times 100 = 49.6\%$

Q. (10) The ratio of two numbers is 3: 5. If both numbers are increased by 8, the ratio becomes 13: 19. What is the sum of the two numbers?

1. 32
2. 48
3. 40
4. 72

Answer: 2

Solution: Let the two numbers be $3x$ and $5x$

Therefore, according to the question,

$$(3x + 8) / (5x + 8) = 13/19$$

$$\Rightarrow 57x + 152 = 65x + 104$$

$$\Rightarrow 8x = 48$$

$$\Rightarrow x = 48/8 = 6$$

Therefore, the sum of the two numbers = $3x + 5x$

$$= 8x$$

$$= 8 \times 6 = 48$$

Q. (11) If $3A = 5B$, then what is the value of $(A + B)/B$?

1. $8/3$
2. $8/5$
3. $5/8$
4. $5/3$

Answer: 1

Solution: Given, $3A = 5B$

$$\Rightarrow B = 3A/5$$

$$\text{Now, } (A + B) = A + (3A/5) = 8A/5$$

$$\text{Therefore, } (A + B) / B = (8A/5) / (3A/5) \\ = 8/3$$

Q. (12) What is the average of the first 29 even numbers?

1. 30
2. 31
3. 32
4. 33

Answer: 1

Solution: Sum of first n even numbers = $n(n+1)$

$$\text{Therefore, sum of first 29 even numbers} = 29(29+1) = 29 \times 30$$

$$\text{Hence, required average} = (29 \times 30)/29 = 30$$

Q. (13) The average of 5 consecutive odd numbers is 27. What is the product of the first and the last number?

1. 621
2. 667
3. 713
4. 725

Answer: 3

Solution:

Average of 5 consecutive odd numbers = 27

Therefore, middle number = 27

Thus, the consecutive odd numbers are 23, 25, 27, 29, 31

Now, the product of first and last numbers = $23 \times 31 = 713$

Q. (14) A man bought 9 pens for a rupee. How many pens should he sell for a rupee to gain 50%?

1. 3
2. 6
3. 7
4. 8

Answer: 2

Solution: Let the number of pens to be sold = x

The cost price of 1 pen = Rs. $1/9$

The selling price of 1 pen = Rs. $1/x$

Therefore, Profit % = $[(S.P. - C.P.) / C.P.] \times 100 = 50\%$

$$\Rightarrow [(1/x - 1/9) / (1/9)] \times 100 = 50$$

$$\Rightarrow [(9 - x) / 9x] \times 9 = 1/2$$

$$\Rightarrow (9 - x) / x = 1/2$$

$$\Rightarrow 18 - 2x = x$$

$$\Rightarrow 3x = 18$$

$$\Rightarrow x = 6$$

Therefore, the number of pens to be sold = 6

Q. (15) On an article, the profit is 210% of the cost price. If the cost price increase by 40% but the selling price remains constant, then approximately what percentage of the selling price will be the profit?

1. 55
2. 62

3. 74
4. 85

Answer: 1

Solution: Let cost price = Rs. 100

Profit = $(210/100) \times 100 = \text{Rs. } 210$

Therefore, Selling price = $210 + 100 = \text{Rs. } 310$

Now new cost price = $100 + [(40/100) \times 100] = \text{Rs. } 140$

Thus, new profit = $\text{Rs.}(310 - 140) = \text{Rs. } 170$

Hence, required % = $(170/310) \times 100 \approx 55\%$

Q. (16) If the price of apple increases from Rs 80/kg to Rs 100/kg, then by what percentage a person should decrease the consumption of apple so that his expenditure remains the same?

1. 25
2. 22
3. 20
4. 18

Answer: 3

Solution: Let the number of apples consumed initially be 10 kg

Therefore, original price = $80 \times 10 = \text{Rs. } 800$

Given, new price = Rs. 100/kg

Hence, new consumption = $800/100 = 8 \text{ kg}$

Thus, required percentage = $(10 - 8)/10 \times 100 = 20\%$

Q. (17) If 25% of a number is 6, then what is the number which is 50% more than the initial number?

1. 36
2. 24
3. 30
4. 18

Answer: 1

Solution: Let the number be y

According to the question,

$$25/100 \times y = 6$$

$$y = 6 \times 4 = 24$$

$$\begin{aligned} \therefore \text{Number which is 50\% more than the initial number} &= 24 + (50/100 \times 24) \\ &= 24 + 12 \\ &= 36 \end{aligned}$$

Q. (18) A boat travels 60 kilometres downstream and 20 kilometres upstream in 4 hours. The same boat travels 40 kilometres downstream and 40 kilometres upstream in 6 hours. What is the speed (in km/hr) of the stream?

1. 24
2. 16
3. 18
4. 20

Answer: 2

Solution: Let speed of boat = x km/hour and speed of stream = y km/hour

Thus, downstream speed = $(x+y)$ km/hour and upstream speed = $(x-y)$ km/hour

Now, Time = distance/speed

$$\text{Hence, } 60/(x+y) + 20/(x-y) = 4$$

$$\Rightarrow 15/(x+y) + 5/(x-y) = 1 \text{ _____ (i)}$$

$$\text{Similarly, } 40/(x+y) + 40/(x-y) = 6$$

$$\Rightarrow 1/(x+y) + 1/(x-y) 40 = 3/20 \text{ _____ (ii)}$$

Solving equations (i) and (ii), we get: $x = 24$ and $y = 16$

\therefore Speed of stream = 16 km/hour

Q. (19) 50 trees are standing in a line such that distance between any two consecutive trees is same. A car takes 18 seconds to travel from 13th tree to 34th tree. How much time (in seconds) will it take to reach from 1st tree to 50th tree?

1. 42
2. 42.85
3. 45
4. 49

Answer: 1

Solution: Let the distance between each tree = m metres

Thus, distance between 1st and 50th tree = 49 m metres

Distance covered by car from 13th to 34th tree = 21 m

Speed of car = $x = 21m/18$

Therefore, time taken to reach from 1st tree to 50th tree = $49m/x$

= $49m/(21m/18)$ seconds

= $49 \times (18/21)$

= 42 seconds

Q. (20) What will be the amount of Rs. 12500 at the rate of 20% per annum compounded yearly for 3 years?

1. 21080
2. 21560
3. 20600
4. 21600

Answer: 4

Solution: Principal sum = Rs. 12,500

Rate of interest = 20% and time period = 3 years

Therefore, amount after compound interest = $P [1 + (R/100)]^T$

= $12500 [1 + (20/100)]^3$

= $12500 \times (6/5)^3$

$$= 100 \times 216$$
$$= \text{Rs. } 21,600$$

Q. (21) A certain sum becomes 7 times in 8 years, at simple interest, then in how many years it will become 19 times?

1. 15
2. 18
3. 28
4. 24

Answer: 4

Solution: Let the principal sum = Rs. P and rate of interest = r%

Amount under simple interest after 8 years = $P + [(P \times R \times T)/100]$

$$\Rightarrow 7P = P + [(P \times r \times 8)/100]$$

$$\Rightarrow 8r/100 = 7 - 1 = 6$$

$$\Rightarrow r = 600/8$$

$$\Rightarrow r = 75\%$$

Let the required time be 't' years.

Therefore, $P + [(P \times 75 \times t)/100] = 19P$

$$\Rightarrow 75t/100 = 19 - 1 = 18$$

$$\Rightarrow t = 1800/75$$

$$\Rightarrow t = 24 \text{ years}$$

Therefore, after 24 years, the sum becomes 19 times.

Q. (22) The radius of a wheel is 3.5 cm. What is the distance (in cm) travelled by the wheel in 20 revolutions?

1. 220
2. 440
3. 880
4. 1320

Answer: 2

Solution: Given, the radius of the wheel is 3.5 cm

Therefore, circumference of the wheel = $2\pi r$

$$= 2 \times \frac{22}{7} \times 3.5$$

$$= 22 \text{ cm}$$

Distance covered in 1 revolution = Circumference of wheel = 22 cm

Hence, the distance (in cm) travelled by the wheel in 20 revolutions = $22 \times 20 = 440 \text{ cm}$

Q. (23) If the perimeter of a square is 44 cm, then what is the diagonal (in cm) of the square?

1. 112
2. 211
3. 11
4. 44 2

Answer: 1

Solution: Let side of the square = $s \text{ cm}$

Therefore, the perimeter of the square = 44 cm

$$\Rightarrow 4s = 44$$

$$\Rightarrow s = 11 \text{ cm}$$

Thus, the diagonal of the square = $(ss) + (ss)$

$$= 2s$$

$$= 112$$

Q. (24) What is the curved surface area (in cm) of a cylinder having radius of base as 14 cm and height as 10 cm?

1. 440
2. 880
3. 220
4. 1320

Answer: 2

Solution:

Given, radius of the cylinder, $r = 14$ cm and height of the cylinder = 10 cm

Therefore, curved surface area = $2\pi rh$

$$= 2 \times \frac{22}{7} \times 14 \times 10$$

$$= 880 \text{ cm}^2$$

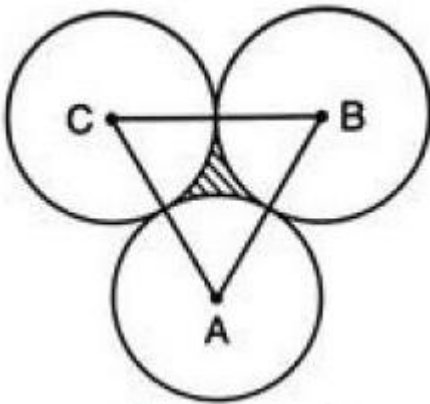
Q. (25) Three circles of radius 63 cm are placed in such a way that each circle touches the other two.

What is the area of the portion enclosed by the three circles?

1. $7938\sqrt{3} - 4158$
2. $3969\sqrt{3} - 4158$
3. $7938\sqrt{3} - 6237$
4. $3969\sqrt{3} - 6237$

Answer: 4

Solution:



Radius of each circle = $r = 63$ cm

$$AC = r + r = 126 \text{ cm}$$

Similarly, $AB = 126$ cm and $BC = 126$ cm

$\triangle ABC$ is an equilateral triangle having $\angle A = \angle B = \angle C = 60^\circ$

Thus, area of shaded portion = (Area of $\triangle ABC$) - (3 x Area of each sector)

$$= \left(\frac{\sqrt{3}}{4} \times s^2\right) - (3 \times \frac{\theta}{360^\circ} \times \pi r^2)$$

$$= \left(\frac{\sqrt{3}}{4} \times 126 \times 126\right) - (3 \times \frac{60^\circ}{360^\circ} \times \frac{22}{7} \times 63 \times 63)$$

$$= (3969\sqrt{3}) - (11 \times 9 \times 63)$$

$$= (3969\sqrt{3} - 6237) \text{ cm}^2$$

Q. (26) If $(x/y)^{5a-3} = (y/x)^{17-3a}$, then what is the value of a ?

1. -7
2. -5
3. 0
4. 3

Answer: 1

Solution:

$$\begin{aligned}(x/y)^{5a-3} &= (y/x)^{17-3a} \\ \Rightarrow (x/y)^{5a-3} &= (y/x)^{3a-17} \\ \Rightarrow 5a-3 &= 3a-17 \\ \Rightarrow 2a &= -14 \\ \Rightarrow a &= -7\end{aligned}$$

Q. (26) What is the value of $(x^2 - x - 6)/(x^2 + x - 12) \div (x^2 + 5x + 6)/(x^2 + 7x + 12)$?

1. 1
2. $(x-3)/(x+3)$
3. $(x+4)/(x-3)$
4. $(x-3)/(x+4)$

Answer: 1

Solution:

$$\begin{aligned}&(x^2 - x - 6)/(x^2 + x - 12) \div (x^2 + 5x + 6)/(x^2 + 7x + 12) \\ &= [(x^2 - x - 6)/(x^2 + x - 12)] \times [(x^2 + 7x + 12)/(x^2 + 5x + 6)] \\ &= [(x-3)(x+2)/(x+4)(x-2)] \times [(x+4)(x+3)/(x+3)(x+2)] \\ &= 1\end{aligned}$$

Q. (27) If $x^2 + 1/x^2 = 7/4$, then what is the value of $x^3 + 1/x^3$?

1. $3\sqrt{3}/\sqrt{5}$
2. $3\sqrt{15}/5$
3. $3\sqrt{15}/8$
4. $3\sqrt{5}/8$

Answer: 3

Solution: $x^2 + 1/x^2 = 7/4$

$$\Rightarrow (x + 1/x)^2 - 2 \cdot x \cdot 1/x = 7/4$$

$$\Rightarrow (x + 1/x)^2 = 7/4 + 2 = 15/4$$

$$\Rightarrow x + 1/x = \sqrt{15/2}$$

Therefore, $(x + 1/x)^3 = (\sqrt{15/2})^3$

$$\Rightarrow x^3 + 1/x^3 + 3 \cdot x \cdot 1/x (x + 1/x) = 15\sqrt{15/8}$$

$$\Rightarrow x^3 + 1/x^3 + (3 \times \sqrt{15/2}) = 15\sqrt{15/8}$$

$$\Rightarrow x^3 + 1/x^3 = 15\sqrt{15/8} - 3\sqrt{15/2}$$

$$\Rightarrow x^3 + 1/x^3 = 3\sqrt{15/8}$$

Q. (28) If $x^2 - 8x + 1 = 0$, then what is the value of $x^2 + 1/x^2$?

1. 18
2. 34
3. 40
4. 62

Answer: 4

Solution:

$$x^2 - 8x + 1 = 0$$

Dividing both sides by 'x',

$$x + 1/x = 8$$

Squaring both sides, we get,

$$x^2 + 2 \cdot x \cdot 1/x + 1/x^2 = 64$$

$$\Rightarrow x^2 + 1/x^2 = 64 - 2 = 62$$

Q. (29) Find the simplified value of:

$$(x^{32} + 1/x^{32}) (x^8 + 1/x^8) (x - 1/x) (x^{16} + 1/x^{16}) (x + 1/x) (x^4 + 1/x^4)$$

1. $x^{64} + 1/x^{64}$
2. $(x^{64} - 1/x^{64}) / (x^2 + 1/x^2)$

3. $(x^{64} - 1/x^{64}) / (x + 1/x)$
4. $(x^{32} - 1/x^{32}) / (x + 1/x)$

Answer: 2

Solution: $(x^{32} + 1/x^{32})(x^8 + 1/x^8)(x - 1/x)(x^{16} + 1/x^{16})(x + 1/x)(x^4 + 1/x^4)$
 $= (x^{32} + 1/x^{32})(x^8 + 1/x^8)(x^2 - 1/x^2)(x^{16} + 1/x^{16})(x^4 + 1/x^4)$

Multiply and divide by $(x^2 + 1/x^2)$, we get,

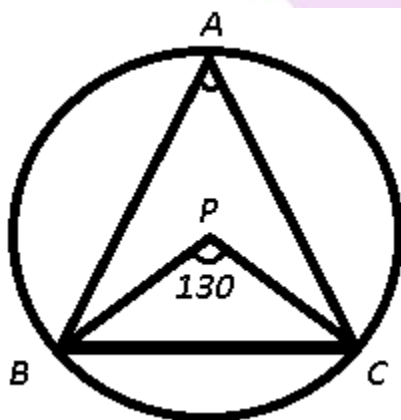
$$\begin{aligned} & 1/(x^2 + 1/x^2) [(x^{32} + 1/x^{32})(x^8 + 1/x^8)(x^2 + 1/x^2)(x^2 - 1/x^2)(x^{16} + 1/x^{16})(x^4 + 1/x^4)] \\ & = 1/(x^2 + 1/x^2) [(x^{32} + 1/x^{32})(x^8 + 1/x^8)(x^4 - 1/x^4)(x^{16} + 1/x^{16})(x^4 + 1/x^4)] \\ & = 1/(x^2 + 1/x^2) [(x^{32} + 1/x^{32})(x^8 + 1/x^8)(x^8 - 1/x^8)(x^{16} + 1/x^{16})] \\ & = 1/(x^2 + 1/x^2) [(x^{32} + 1/x^{32})(x^{16} - 1/x^{16})(x^{16} + 1/x^{16})] \\ & = 1/(x^2 + 1/x^2) [(x^{32} + 1/x^{32})(x^{32} - 1/x^{32})] \\ & = (x^{64} - 1/x^{64}) / (x^2 + 1/x^2) \end{aligned}$$

Q. (30) If P is the circum-center in ΔABC , $\angle BPC = 130^\circ$, then what is the value (in degrees) of $\angle BAC$?

1. 30
2. 60
3. 65
4. 105

Answer: 3

Solution:



In a circle, the angle subtended by an arc at the centre is double the angle subtended by the same arc on any other point on the circle.

Therefore, $\angle BPC = 2 \times \angle BAC$

$$\Rightarrow \angle BAC = \angle BPC / 2$$

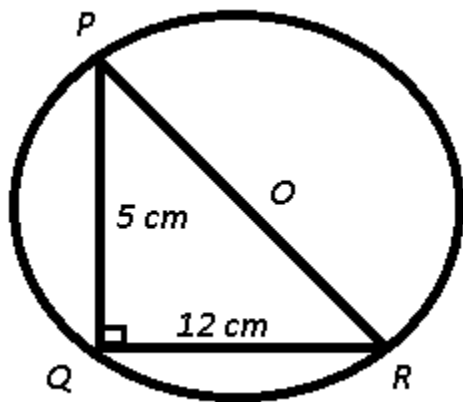
$$\Rightarrow \angle BAC = 130^\circ / 2 = 65^\circ$$

Q. (31) In $\triangle PQR$, $\angle PQR = 90^\circ$, $PQ = 5$ cm and $QR = 12$. What is the radius (in cm) of the circum-circle of $\triangle PQR$?

1. 6.5
2. 7.5
3. 13
4. 15

Answer: 1

Solution:



In $\triangle PQR$,

$$(PR)^2 = (QR)^2 + (PQ)^2$$

$$= 12^2 + 5^2$$

$$= 144 + 25$$

$$= 169$$

Hence, $PR = \sqrt{169} = 13$ cm

Also, in a right angled triangle, circumradius is half the hypotenuse of the triangle.

Thus, $OR = r = 13/2 = 6.5$ cm

Q. (32) What is the simplified value of $\operatorname{cosec} 2A + \cot 2A$?

1. $\sec A$
2. $\sec (A/2)$
3. $\cot A$
4. $\cot^2 A$

Answer: 3

Solution:

Expression: $\operatorname{cosec} 2A + \cot 2A$

We know that

$$\operatorname{cosec} 2A = 1/\sin 2A$$

$$\Rightarrow \cot 2A = \cos 2A/\sin 2A$$

Substitute in the given expression, we get

$$= (1/\sin 2A) + (\cos 2A/\sin 2A)$$

$$= (1 + \cos 2A)/\sin 2A$$

$$= [1 + (2\cos^2 A - 1)] / 2\sin A \cos A \text{ [The formula for } \sin 2A = 2 \sin A \cos A \text{]}$$

$$= 2\cos^2 A / 2\sin A \cos A$$

$$= \cos A / \sin A \text{ [Since } \cos A / \sin A = \cot A \text{]}$$

$$= \cot A$$

Q. (33) What is the simplified value of $(\sec A + \cos A)(\sec A - \cos A)$?

1. $2 \tan^2 A$
2. $2 \sin^2 A$
3. $\sin^2 A \tan^2 A$
4. $\sin^2 A + \tan^2 A$

Answer: 4

Solution:

$$(\sec A + \cos A)(\sec A - \cos A)$$

We know that, $\sec A = 1/\cos A$

Substitute the identity in the given form:

$$[(1/\cos A) + \cos A][(1/\cos A) - \cos A]$$

$$= [(1 + \cos^2 A)/\cos A][(1 - \cos^2 A)/\cos A]$$

$$= (1 + \cos^2 A)(\sin^2 A / \cos^2 A)$$

$$= (\sin^2 A / \cos^2 A) + \sin^2 A$$

Since, $\sin A / \cos A = \tan A$, therefore, the above expression becomes $\tan^2 A + \sin^2 A$

Q. (34) If $2\cos \theta = 2 - \sin \theta$, then what is the value of $\cos \theta$?

1. 1 or $3/5$
2. 1 or $-1/2$
3. -1 or $-1/2$
4. -1 or $3/5$

Answer: 1

Solution:

$$2 \cos \theta = 2 - \sin \theta$$

$$\Rightarrow 2 \cos \theta = 2 - \sqrt{1 - \cos^2 \theta}$$

$$\Rightarrow \sqrt{1 - \cos^2 \theta} = 2 - 2\cos \theta$$

Take square on both sides, it becomes

$$\Rightarrow \sqrt{1 - \cos^2 \theta}^2 = (2 - 2 \cos \theta)^2$$

$$\Rightarrow 1 - \cos^2 \theta = 4 + 4 \cos^2 \theta - 8 \cos \theta$$

$$\text{Let } \cos \theta = x$$

$$\Rightarrow 5x^2 - 8x + 3 = 0$$

$$\Rightarrow 5x^2 - 5x - 3x + 3 = 0$$

Factorize the above equation,

$$\Rightarrow 5x(x - 1) - 3(x - 1) = 0$$

$$\Rightarrow (5x - 3)(x - 1) = 0$$

$$\Rightarrow 5x = 3, x = 1$$

$$\Rightarrow x = \cos \theta = 1, 3/5$$

Q. (35) If $(1/\cos \theta) - (1/\cot \theta) = 1/P$, then what is the value of $\cos \theta$?

1. $(P + 1)/(P - 1)$
2. $(P^2 + 1)/2P$
3. $2(P^2 + 1)/P$

4. $2P/(P^2 + 1)$

Answer: 4

Solution:

Expression: $(1/\cos \theta) - (1/\cot \theta) = 1/p$

Substitute the identity, $\cot \theta = \cos \theta / \sin \theta$

$$\Rightarrow (1/\cos \theta) - (\sin \theta / \cos \theta) = 1/p$$

$$\Rightarrow 1 - [(1 - \cos^2 \theta) / (\cos \theta)] = 1/p$$

Let $\cos \theta = x$

$$\Rightarrow 1 - [1 - x^2] = x / p$$

$$\Rightarrow 1 - (x / p) = \sqrt{[1 - x^2]}$$

Taking squares on both sides, we get

$$\Rightarrow (1 - (x/p))^2 = (\sqrt{[1 - x^2]})^2$$

$$\Rightarrow 1 + (x^2/p^2) - 2(x/p) = 1 - x^2$$

$$\Rightarrow (x^2/p^2) - 2(x/p) + x^2 = 0$$

$$\Rightarrow (x^2 - 2xp + x^2p^2) / (p^2) = 0$$

Simplify the above expression,

$$\Rightarrow x - 2p + xp^2 = 0$$

$$\Rightarrow x(1 + p^2) = 2p$$

$$\Rightarrow x = \cos \theta = (2p) / (1 + p^2)$$

Directions Q. (36 - 39): The table given below shows the runs scored by 5 players in four matches.

PLAYER	Match I	Match II	Match III	Match IV
A	70	105	55	135
B	40	35	95	72
C	60	68	75	85
D	95	45	55	60
E	105	110	125	122

Q. (36) What is the difference between total runs scored by A and B in four matches?

1. 111
2. 123
3. 98
4. 135

Answer: 2

Solution: Total runs scored by A in four matches = $70 + 105 + 55 + 135 = 365$

Total runs scored by B in four matches = $40 + 35 + 95 + 72 = 242$

Hence, required difference = $365 - 242 = 123$

Q. (37) Runs scored by C in match II is how much percent more than the runs scored by C in match I?

1. 11.76
2. 16.66
3. 17.12
4. 13.33

Answer: 4

Solution: Runs scored by C in match I = 60

Runs scored by C in match II = 68

Therefore, required % = $(68 - 60)/60 \times 100$

= $800/60$

= 13.33 %

Q. (38) Runs scored by A in match II is what percent of the total runs scored by these five players in match II?

1. 71.07
2. 35.14
3. 28.92
4. 55.13

Answer: 3

Solution: Runs scored by A in match II = 105

Total runs scored by these five players in match II = $105 + 35 + 68 + 45 + 110 = 363$

Required % = $105/363 \times 100 = 28.92 \%$

Q. (39) What is the correct order of averages of the given players in the 4 matches?

1. $E > A > C > D > B$
2. $E > A > D > C > B$
3. $A > E > C > D > B$
4. $A > E > B > C > D$

Answer: 1

Solution: Decreasing order of average = Decreasing order of total runs scored.

Runs scored by:

$A = 70 + 105 + 55 + 135 = 365$

$B = 40 + 35 + 95 + 72 = 242$

$C = 60 + 68 + 75 + 85 = 288$

$D = 95 + 45 + 55 + 60 = 255$

$$E = 105 + 110 + 125 + 122 = 462$$

Decreasing order = **E > A > C > D > B**

Q. (40) If $\triangle ABC$ is right angled at B, $AB = 30$ and $\angle ACB = 60^\circ$, then what is the value of AC?

1. 20
2. $20\sqrt{3}$
3. 60
4. 40

Answer: 2

Solution: It is given that $\triangle ABC$ is a right angled at B, $AB = 30$ cm and $\angle C = 60^\circ$

Now, in right $\triangle ABC$,

$$\sin(\angle C) = AB/AC$$

$$\Rightarrow \sin(60^\circ) = 30/AC$$

$$\Rightarrow \sqrt{3}/2 = 30/AC$$

$$\Rightarrow AC = 2/\sqrt{3} \times 30$$

$$\Rightarrow AC = 20\sqrt{3}$$

Q. (41) What is the simplified value of $(\operatorname{cosec}^4 A - \cot^2 A) - (\cot^4 A + \operatorname{cosec}^2 A)$?

1. 0
2. 5
3. 6
4. 9

Answer: 1

Solution:

$$\text{Given: } (\operatorname{cosec}^4 A - \cot^2 A) - (\cot^4 A + \operatorname{cosec}^2 A)$$

Arranging the similar powers together, we get

$$= (\operatorname{cosec}^4 A - \cot^4 A) + (-\operatorname{cosec}^2 A - \cot^2 A)$$

$$= [(\operatorname{cosec}^2 A + \cot^2 A)(\operatorname{cosec}^2 A - \cot^2 A)] + (-\operatorname{cosec}^2 A - \cot^2 A)$$

$$\text{We know that } (\operatorname{cosec}^2 A - \cot^2 A) = 1$$

$$= (\operatorname{cosec}^2 A - \operatorname{cosec}^2 A) + (\cot^2 A - \cot^2 A)$$

$$= 0$$

Q. (42) What is the simplified value of $(\cos A + \sin A)(\cot A + \tan A)$?

1. $\sec A + \operatorname{cosec} A$
2. $\sin A + \cos A$
3. $\tan A + \cot A$
4. $\sec A - \operatorname{cosec} A$

Answer: 1

Solution:

Given: $(\cos A + \sin A)(\cot A + \tan A)$

By applying the identity $\cot A = \cos A / \sin A$, and $\tan A = \sin A / \cos A$, we get

$$\begin{aligned} & (\cos A + \sin A) \left[\left(\frac{\cos A}{\sin A} \right) + \left(\frac{\sin A}{\cos A} \right) \right] \\ &= (\cos A + \sin A) \left[\frac{(\sin^2 A + \cos^2 A)}{\sin A \cos A} \right] \\ &= (\cos A + \sin A) / \sin A \cos A \\ &= \left(\frac{\cos A}{\sin A \cos A} \right) + \left[\frac{\sin A}{\sin A \cos A} \right] \end{aligned}$$

Cancel the terms, it becomes

$$= \left(\frac{1}{\sin A} \right) + \left(\frac{1}{\cos A} \right)$$

Since, $1/\sin A = \operatorname{cosec} A$ and $1/\cos A = \sec A$

$$= \operatorname{Cosec} A + \sec A$$

Q. (43) What is the simplified value of $\sec^4 \theta - \sec^2 \theta \tan^2 \theta$?

1. $\operatorname{cosec}^2 \theta$
2. $\sec^2 \theta$
3. $\cot^2 \theta$
4. $\sec \theta \tan \theta$

Answer: 2

Solution:

Given Expression : $\sec^4 \theta - \sec^2 \theta \tan^2 \theta$

Take $\sec^2 \theta$ as common, we get

$$= \sec^2 \theta (\sec^2 \theta - \tan^2 \theta)$$

Since $(\sec^2 \theta - \tan^2 \theta = 1)$

Substituting the value, we get:

$$= \sec^2 \theta(1)$$

$$= \sec^2 \theta$$

Q. (44) What is the simplified value of $(\sin A - \operatorname{cosec} A)(\sec A - \cos A)(\tan A + \cot A)$?

1. 1
2. -1
3. 0
4. 2

Answer: 2

Solution:

Given: $(\sin A - \operatorname{cosec} A)(\sec A - \cos A)(\tan A + \cot A)$

$$= (\sin A - 1/\sin A)(1/\cos A - \cos A)(\sin A/\cos A + \cos A/\sin A)$$

$$= [(\sin^2 A - 1)/\sin A] \times [(1 - \cos^2 A)/\cos A] \times [(\sin^2 A + \cos^2 A)/(\sin A \cos A)]$$

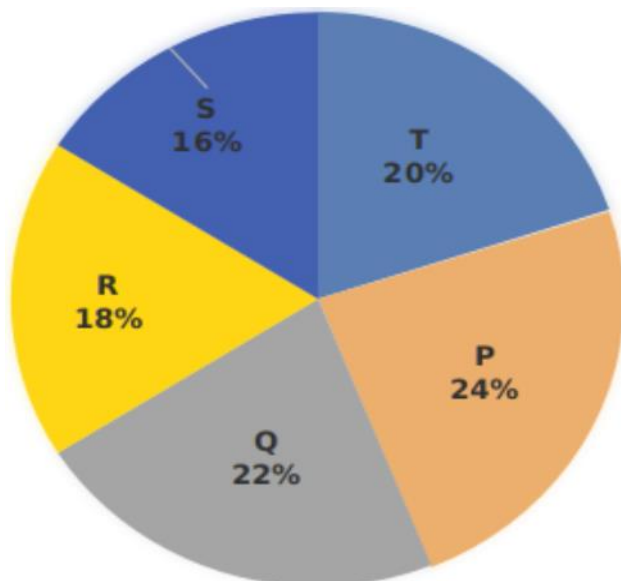
$$= [-\cos^2 A/\sin A] \times [\sin^2 A/\cos A] \times [1/\sin A \cos A]$$

$$= -\cos^2 A \sin^2 A / \sin^2 A \cos^2 A$$

$$= -1$$

Directions Q. (45 - 50): The following pie chart shows the expenditure (in percentage) of five companies P, Q, R, S and T in the year 2016.

Total Expenditure = 48 crores.



Q. (45) What was the total expenditure (in Rs crores) of the company Q, R and T together?

1. 19.2
2. 28.8
3. 24.3
4. 31.4

Answer: 2

Solution: Total expenditure (in Rs crores) = 48

Percentage of expenditure of the company Q, R and T together = $(22 + 18 + 20) = 60\%$

Total expenditure (in crores) of the company Q, R and T together = $(60/100) \times 48$

= $144/5$

= 28.8

Q. (46) By how much percent expenditure of company Q and R together greater than that of company P?

1. 33.33
2. 60
3. 66.67
4. 75

Answer: 3

Solution: Percentage of amount spent by company P = 24%

Percentage of amount spent by company Q and R = $(22 + 18) = 40\%$

Required percent = $[(40 - 24)/24]/100$

= $2/3 \times 100$

= 66.67%

Q. (47) What is the respective ratio between the total expenditure of company P, Q and S together to the total expenditure?

1. 31:60
2. 50:31
3. 60:31
4. 31:50

Answer: 4

Solution: Total expenditure of company P, Q and S together (in %) = $(24 + 22 + 16) = 62\%$

Total expenditure of all companies (in %) = 100%

Required ratio = $62/100$

= $62/100$

= 31 : 50

Q. (48) Total amount spent by company S is what percent of total amount spent by company T and R?

1. 42.1
2. 43
3. 39.68
4. 41

Answer: 1

% amount spent by company S = 16%

% amount spent by company T and R = $(20+18) = 38\%$

Required percent spent by company S = $16/38 \times 100$

= $800/19$

= 42.1

Q. (49) The profit earned by company R is equal to the 1/4th of the expenditure of company Q. What is the profit (in Rs crores) of company R?

1. 3.24
2. 4.84
3. 2.64
4. 5.66

Answer: 3

Solution:

Total expenditure (in Rs crores) = 48

Expenditure of company Q = $22/100 \times 48$

Hence, the profit earned by company R = 1/4th of expenditure of company Q

$$\begin{aligned} &= 1/4 \times 22/100 \times 48 \\ &= (22 \times 12)/100 \\ &= 2.64 \end{aligned}$$

Q. (50) If $\sin 3\theta \sec 2\theta = 1$, then what is the value of $[3 \tan^2 (5\theta/2) - 1]$?

1. 0
2. 1
3. 2
4. 3

Answer: 3

Solution: Given, $\sin 3\theta \sec 2\theta = 1$

$$\Rightarrow \sin 3\theta = 1/\sec 2\theta$$

$$\Rightarrow \sin 3\theta = \cos 2\theta$$

$$\Rightarrow \sin 3\theta = \sin (90 - 2\theta)$$

$$\Rightarrow 3\theta = 90 - 2\theta$$

$$\Rightarrow 5\theta = 90$$

$$\Rightarrow \theta = 18$$

$$\text{Therefore, } [3 \tan^2 (5\theta/2) - 1] = 3 \tan^2 45 - 1$$

$$= 3(1) - 1$$

$$= 2$$