SSC CGL Previous Year Question Paper 2016

Quantitative Aptitude (Questions and Answers)

Q. (1) What is the simplified value of 1 + tan A tan (A/2)?

1. sin A/2
2. cos A
3. sec A
4. sin A

Answer: 3

Solution:

By using the double- identity:

tan (2a) = 2 tan (a) / (1- $\tan^2$ a)

Therefore, 1 + [tan A. tan (A/2)] = 1 + [2tan (A/2) / (1- $\tan^2$ (A/2))] × tan (A/2)]

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

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

=sec2 (A/2)

Cancel the number 2, we get, 1 + [tan A. tan (A/2)] = sec A

Q. (2) What is the simplified value of $\sin^2$ (90 – θ) – [{sin (90 – θ) sin θ}/tan θ]?

1. 1
2. cosec θ
3. 0
4. cos θ

Answer: 3

Solution:

Expression: $\sin^2$ (90°- θ) - [(sin (90°- θ) sinθ) / tanθ]

We know that, the identity, sin (90°- θ) = cosθ

Substitute the above identity, we get

= $\cos^2$θ - (cosθ.sinθ / tanθ)

Since, tan θ = sinθ/cosθ

= $\cos^2\theta$ - [($\cos\theta$ $\sin\theta$)/ ($\sin\theta/\cos\theta$)]

= $\cos^2\theta$ - $\cos^2\theta$

= 0

Q. (3) The in-radius of an equilateral triangle is 10 cm. What is the circum-radius (in cm) of the same triangle?

1. 5
2. $10\sqrt{3}$
3. 20
4. $20\sqrt{3}$

Answer: 3

Solution: Let, the circum-radius be R

For an equilateral triangle, ratio of circum-radius and inradius = 2: 1

Therefore, R/10 = 2/1

Hence, R = 20 cm

Q. (4) ABC is an equilateral triangle and P is the orthocenter of the triangle, then what is the value (in degrees) of ∠BPC?

1. 90
2. 120
3. 135
4. 145

Answer: 2

Solution: ABC is an equilateral triangle, therefore, ∠A = 60°

Therefore, ∠BPC = 90° + ∠A/2

= 90° + 60°/2

= 120°

Q. (5) In a triangle ABC, AD is the angle bisector of ∠A and AB: AC = 3: 4. If the area of triangle ABC is 350 cm^2, then what is the area (in cm^2) of triangle ABD?

1. 150
2. 200
3. 210
4. 240

Answer: 1

Solution: Since, in triangle ABC, AD is the angle bisector of ∠A and AB : AC = 3 : 4

Therefore, (area of △ ABD) / (area of △ ADC) = ¾

Also, area of △ ABC = 350 cm^2

Hence, area of △ ABD = [3 / (3 + 4)] x 350

= 3 x 50 cm^2

= 150 cm^2

Q. (6)

The value of $\sec^2 17° - \frac{1}{\tan^2 73°} - \sin 17° \sec 73°$ is

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

Answer: 2

Solution: Expression: $\sec^2 17° - [1/\tan^2 73°] - \sin 17° \sec 73°$

We know that, the identity 1/ tan A = Cot A

= [$\sec^2 17° - \cot^2 73°$] - [sin 17° x sec (90° - 17°)]

Using the trigonometry identity,

sec (90° - θ) = cosec θ and cot(90° - θ) = tan θ

= $\sec^2 17° - \tan^2 (90°-17°)$ - [sin 17° x cosec 17°]

Using, sin θ cosec θ = 1 and ($\sec^2\theta - \tan^2\theta = 1$)

= ($\sec^2 17° - \tan^2 17°$) - 1

= 1 - 1

= 0

Q. (7) If tan θ = tan 30 °. tan 60° and θ is an acute angle, then 2θ is equal to

1. 30°
2. 45°
3. 90°
4. 0°

Answer: 3

Solution:

Given, tan θ = tan 30°. tan 60°

We know, tan 30° = 1/√3

⇒ tan 60° = √3

So, tan 30°. tan 60° = 1

Thus, tan θ = 1

⇒ θ = 45°

So, 2θ = 90°

Q. (8) If sin 5θ + sin θ = sin 3θ and 0 < θ < (π/2), then what is the value of θ (in degrees)?

1. 30
2. 45
3. 60
4. 75

Answer: 1

Solution: Sin 5θ + Sin θ = sin 3θ

Using, Sin A + Sin B = 2 Sin [(A+ B)/2] cos [(A-B)/2]

The given trigonometric expression Sin 5θ + Sin θ is written as:

2 Sin [(θ + 5θ)/2] Cos [(5θ - θ) /2]

Therefore, 2 Sin [(θ + 5θ)/2] Cos [(5θ - θ) /2] = sin 3θ

⇒ 2 sin 3θ cos 2θ = sin 3θ

⇒ Cos 2θ= sin 3θ / 2sin 3θ

Cancel sin 3θ in R.H.S

Therefore, Cos 2θ = ½ = cos 60° [The value ½ corresponds to cos θ is cos 60°]

⇒ Cos 2θ= cos 60°

Remove cos on both the sides

2θ= 60°

⇒ θ = 30°

Q. (9) If A = 30°, B = 60° and C = 135°, then what is the value of $\sin^3 A + \cos^3 B + \tan^3 C - 3\sin A \cos B \tan C$?

1. 0
2. 1
3. 8
4. 9

Answer: 2

Solution:

Given Values are: A = 30°, B = 60° and C = 135°

Therefore, $\sin^3 A + \cos^3 B + \tan^3 C - 3\sin A \cos B \tan C$

$=[\sin(30°)]^3 + [\cos(60°)]^3 + [\tan(135°)]^3 - 3 \sin(30°) \cos(60°) (\tan(90°)$

Substitute the trigonometric ratio values and simplify the given expression

$= (1/2)^3 + (1/2)^3 + (-1)^3 - 3(½) (½) (-1)$

= (⅛) + (⅛) - 1 + (¾)

= (¼) - (¼)

= 0

Q. (10) If tan A = 1/2 and tan B = 1/3, then what is the value of tan (2A + B)?

1. 1
2. 3
3. 5
4. 9

Answer: 2

Solution:

Given, tan A = 1/2 and tan B = ⅓

From trigonometric identities, we know:

$\tan 2A = 2\tan A/1 - \tan^2 A$

⇒ tan 2A = (2 x ½) ÷ (1-¼)

⇒ tan 2A = 1 ÷ ¾

⇒ tan 2A = 4/3

Hence, tan (2A + B) = (tan 2A tan B)/ (1-tan 2A tan B)

= (4/3 + ⅓) ÷ [1 - (¼) (⅓)]

= (5/3) ÷ (1 - 4/9)

= (5/3) ÷ (9 - 4/9)

= 5/3 x 9/5

= 3

Q. (11) If 27x + 27[x - (⅓)] = 99, then what is the value of x?

1. 2
2. 3
3. 4
4. 5

Answer: 1

Solution: 27x + 27[x - (⅓)] = 99

⇒ 27x + 27[(3x - 1)/3] = 99

⇒ 27x + 9(3x − 1) = 99

⇒ 27x + 27x − 9 = 99

⇒ 54x = 108

⇒ x = (108 / 54) = 2

Q. (12) If $x = 5 - 2\sqrt{6}$, then what is the value of $\sqrt{x} + (1/\sqrt{x})$?

1. 5
2. 2
3. $2\sqrt{3}$
4. $2\sqrt{2}$

Answer: 3

Solution: $x = 5 - 2\sqrt{6}$

$\Rightarrow x = 3 + 2 - 2(3)(2)$

$\Rightarrow x = (\sqrt{3})^2 + (\sqrt{2})^2 - 2(3).(2)$

$\Rightarrow x = (\sqrt{3} - \sqrt{2})^2$

$\Rightarrow \sqrt{x} = \sqrt{3} - \sqrt{2}$

$\Rightarrow 1/\sqrt{x} = 1/(\sqrt{3} - \sqrt{2})$

$\Rightarrow 1/\sqrt{x} = [1/(\sqrt{3} - \sqrt{2})] \times [(\sqrt{3} + \sqrt{2}) / (\sqrt{3} + \sqrt{2})]$

$\Rightarrow 1/\sqrt{x} = (\sqrt{3} + \sqrt{2}) / (3 - 2)$

$\Rightarrow 1/\sqrt{x} = \sqrt{3} + \sqrt{2}$

Hence, $\sqrt{x} + (1/\sqrt{x}) = (\sqrt{3} - \sqrt{2}) + (\sqrt{3} + \sqrt{2})$

$= 2\sqrt{3}$

Q. (13) A sum amounts to Rs 7727.104 at the rate of 12% per annum compounded annually after three years. What is the value of principal (in Rs.)?

1. 5000
2. 5200
3. 5350
4. 5500

Answer: 4

Solution: Let principal value = Rs. P

Rate of interest = 12%

Time period = 3 years

Amount under compound interest = $P(1 + R/100)^T$

$\Rightarrow P(1 + 12/100)^3 = 7727.104$

$\Rightarrow P(28/25)^3 = 7727.104$

$\Rightarrow P = 7727.104 \times (15625 / 21952)$

$\Rightarrow P = 15625 \times 0.352 = \text{Rs. } 5500$

Q. (14) A runner starts running from a point at 6:00 am with a speed of 8 km/hr. Another racer starts from the same point at 8:30 am in the same direction with a speed of 10 km/hr. At what time of the day (in p.m.) will the second racer will overtake the other runner?

1. 8:00
2. 4:00
3. 6:30
4. 5:30

Answer: 3

Solution: Speed of first runner = 8 km/hr starting at 6:00 am

Speed of second runner = 10 km/hr starting at 8:30 am

Therefore, distance covered by the first runner till 8:30 am (2.5 hours) = 8 x 2.5 = 20 km

Also, relative speed = 10 - 8 = 2 km/hr

Time taken to overtake the first runner = distance/speed = 20/2 = 10 hours

Therefore, time of the day when the second racer will overtake the other runner

= 8:30 am + 10 hours

= 6:30 pm

Q. (15) If A is 6 times more than B, then by what percentage is B is less than A?

1. 64.82
2. 83.33
3. 28.56
4. 85.71

Answer: 4

Solution: A = B + 6B

⇒ A = 7B

Therefore, required % = (A - B)/A x 100

= (7B - B)/7B x 100%

= 6/7 x 100%

= 600/7 %

= 85.71 %

Q. (16) How many spherical balls of radius 1 cm can be made by melting a hemisphere of radius 6 cm?

1. 112
2. 108
3. 116
4. 104

Answer: 2

Solution:

Let n balls can be made.

Volume of hemisphere = n x Volume of sphere

$\Rightarrow$ n x 4/3 $\pi(r)^3 = \frac{2}{3} \pi(R)^3$

$\Rightarrow 2n \times (1)^3 = (6)^3$

$\Rightarrow n = 216/2 = 108$

Q. (17) Product of three consecutive odd numbers is 1287. What is the largest of the three numbers?

1. 9
2. 11
3. 13
4. 17

Answer: 3

Solution: Let the three consecutive odd numbers be (x - 2), (x) and (x + 2)

Therefore, according to the question,

(x - 2) (x) (x + 2) = 1287

$\Rightarrow x(x^2 - 4) = 11 \times 117$

$\Rightarrow x = 11$ and $(x^2 - 4) = 117$

Therefore, largest of the three numbers = 11 + 2 = 13

Q. (18) The marked price of a shirt is Rs 1280. If the shirt is being sold for Rs 900, then what is the discount percentage?

1. 31.31
2. 25.57
3. 29.68
4. 34.36

Answer: 3

Solution:

Marked price = Rs. 1280

Selling price = Rs. 900

Therefore, discount % = (1280 - 900)/1280 x 100

= (380/12.8)

= 29.68

Q. (19) The ratio of the number of cans of orange, pineapple and mixed fruit juices kept in a store is 8: 9: 15. If the store sells 25%, 33.33% and 20% of orange, pineapple and mixed fruit juices cans respectively, then what is the ratio of the number of cans of these juices in the remaining stock?

1. 1: 1: 2
2. 6: 6: 13
3. 12: 15: 19
4. 4: 9: 13

Answer: 1

Solution: Let the number of cans of orange, pineapple and mixed fruit juices be 8, 9 and 15 respectively.

The store sells 25% orange.

Hence, orange sold = 25/100 x 8 = 2

Therefore, orange left = 8 - 2 = 6

Similarly, pineapple left = 9 - 1/3 x 9 = 6

Mixed fruit left = 15 - 20/100 x 15

= 15 - 3 = 12

Hence, required ratio = 6:6:12 = 1:1:2

Q. (20) The ratio of the number of boys and girls in a class is 2 : 3. The average weight of boys and girls in the class is 18 kg and 21 kg respectively. What is the average weight (in kgs) of all the boys and girls together?

1. 99/5
2. 101/5
3. 109/6
4. 96/5

Answer: 1

Solution: Let the number of boys in class = 2 and number of girls = 3

Average weight of boys = 18 kg

Therefore, the total weight of boys = 18 x 2 = 36 kg

Similarly, the total weight of girls = 21 x 3 = 63 kg

Therefore, average weight (in kg) of all the boys and girls together = (36 + 63) / (2 + 3)

= 99/5

Q. (21) The price of rice has increased by 60%. In order to restore the original price, the new price must be reduced by

1. 33 ⅓ %
2. 37 ½ %
3. 40%
4. 45%

Answer: 2

Solution: Let the original price of rice = Rs. 100

New price = [(100 + 60) / 100] x 100

= Rs. 160

To restore to its original value the new price must be reduced by = [(160 - 100) / 160] x 100

= (6 x 25) / 4 = 37 ½ %

Q. (22) What is the least value of $\tan^2\theta + \cot^2\theta + \sin^2\theta + \cos^2\theta + \sec^2\theta + \text{cosec}^2\theta$?

1. 1
2. 3
3. 5
4. 7

Answer: 4

Solution:

Given expression: $\tan^2\theta + \cot^2\theta + \sin^2\theta + \cos^2\theta + \sec^2\theta + \text{cosec}^2\theta$

Minimum value of $\sin^2\theta + \cos^2\theta = 1$

Minimum value of $\tan^2\theta + \cot^2\theta = 2$

Minimum value of $(a\,\text{cosec}^2\theta + b\sec^2\theta) = (\sqrt{a} + \sqrt{b})^2$

Here, the value of a and b is 1,

Now, substitute it: $(\sqrt{1} + \sqrt{1})^2 = (2\sqrt{1})^2 = 4$

Hence, the required minimum value for the given expression is 1+ 2+ 4 = 7

Q. (23) What is the simplified value of $\text{cosec}^6 A - \cot^6 A - 3\,\text{cosec}^2 A \cot^2 A$?

1. –2
2. –1
3. 0
4. 1

Answer: 1

Solution:

Given, $\text{cosec}^6 A - \cot^6 A - 3\,\text{cosec}^2 A \cot^2 A$

$= (\text{cosec}^2 A)^3 - (\cot^2 A)^3 - 3(\text{cosec}^2 A)(\cot^2 A)(1)$

$= (\text{cosec}^2 A)^3 - (\cot^2 A)^3 - 3(\text{cosec}^2 A)(\cot^2 A)(\text{cosec}^2 A - \cot^2 A)$ [Since, $(\text{cosec}^2 A - \cot^2 A = 1)$]

We know, by algebraic identities;

$x^3 - y^3 - 3xy(x - y) = (x - y)^3$

Therefore, $(\text{cosec}^2 A - \cot^2 A)^3$

$= (1)^3$

$= 1$

Q. (24) If θ be positive acute angle and 5cosθ + 12sinθ = 13, then the value of cosθ is

1. 12/13
2. 5/13
3. 5/12
4. 1/5

Answer: 2

Solution:

Given,

$5\cos\theta + 12\sin\theta = 13$

Now, divide the equation with cosθ

$5 + 12\tan\theta = 13\sec\theta$,

Square both the sides,

$25 + 144\tan\theta^2 + 120\tan\theta = 169\sec^2\theta = 169(\tan^2\theta + 1)$

$\Rightarrow 25(\tan\theta)^2 - 120\tan\theta + 144 = 0$

i.e. $(5\tan\theta - 12)^2 = 0$

$\Rightarrow \tan\theta = 12/5$

Now, if tanθ = 12/5, the perpendicular and adjacent side of the triangle will be 12 and 5 respectively.

So, the hypotenuse will be 13 (as 5, 12, 13 are Pythagorean triplets).

Thus, cosθ will be adjacent side/hypotenuse.

$\Rightarrow \cos\theta = 5/13$

Q. (25) An arc of 30° in one circle is double an arc in a second circle, the radius of which is three times the radius of the first. Then the angles subtended by the arc of the second circle at its centre is:

1. 3°
2. 4°
3. 5°
4. 6°

Answer: 3

Solution: For the first circle, the angle subtended = 30° and let radius = r cm

For the second circle, let angle subtended = θ and radius = 3r cm

According to question, the arc of first circle = 2 x arc of the second circle

⇒ 30°/360° x 2πr = 2 x θ/360° x 2π (3r)

⇒ 60πr = 12 × θπr

⇒ θ = 60 / 12 = 5°