Q41. If $\cos\theta = \frac{1}{\sqrt{5}}$, where $0 < \theta < \frac{\pi}{2}$, then $\frac{2\tan\theta}{1-\tan^2\theta}$ is equal to

(a) 4/3
(b) –4/3
(c) 1/3
(d) –2/3

Q42. If $0 < \theta < 90°$, $0 < \phi < 90°$ and $\cos\theta < \cos\phi$, then which one of the following is correct?

(a) $\theta < \phi$
(b) $\theta > \phi$
(c) $\theta + \phi = 90°$
(d) No conclusion can be drawn

Q43. On the top of a hemispherical dome of radius r, there stands a flag of height h. From a point on the ground, the elevation of the top of the flag is 30°. After moving a distance d towards the dome, when the flag is just visible, the elevation is 45°. The ratio of h to r is equal to

(a) $\sqrt{2} - 1$
(b) $\frac{\sqrt{3}+1}{2\sqrt{2}}$
(c) $\frac{\sqrt{3}+1}{2\sqrt{2}}d$
(d) $\frac{(\sqrt{3}+1)(\sqrt{2}-1)}{2\sqrt{2}}d$

Q44. Let $\sin(A + B) = \frac{\sqrt{3}}{2}$ and $\cos B = \frac{\sqrt{3}}{2}$, where A, B are acute angles. What is $\tan(2A - B)$ equal to?

(a) 1/2
(b) $\sqrt{3}$
(c) $\frac{1}{\sqrt{3}}$
(d) 1

Q45. Consider the following statements:

1. If $\frac{\cos\theta}{1-\sin\theta} + \frac{\cos\theta}{1+\sin\theta} = 4, where\ 0 < \theta < 90°$, then $\theta = 60°$.
2. If $3\tan\theta + \cot\theta = 5\,\mathrm{cosec}\,\theta$, where $0 < \theta < 90°$, then $\theta = 60°$

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

defence.adda247.com
Prepare for Defence Exams

Q46. Consider the following statements:

1. $\cos^2\theta = 1 - \frac{p^2+q^2}{2pq}$, where p, q are non-zero real numbers, is possible only when p = q.

2. $\tan^2\theta = \frac{4pq}{(p+q)^2} - 1$, where p, q are non-zero real numbers, is possible only when p = q.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Q47. Consider the following statements:

1. cos θ + sec θ can never be equal to 1.5.

2. $\sec^2\theta + cosec^2\theta$ can never be less than 4.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Q48. If $\sin^2 x + \sin x = 1$, then what is the value of $\cos^{12} x + 3\cos^{10} x + 3\cos^8 x + \cos^6 x$?

(a) –1
(b) 0
(c) 1
(d) 8

Q49. If 3 sin θ + 5 cos θ = 4, then what is the value of $(3\cos\theta - 5\sin\theta)^2$?

(a) 9
(b) 12
(c) 16
(d) 18

Q50. If cot θ (1 + sin θ) = 4m and cot θ (1 – sin θ) = 4n, then which one of the following is correct?

(a) $(m^2 + n^2)^2 = mn$
(b) $(m^2 - n^2)^2 = mn$
(c) $(m^2 - n^2)^2 = m^2n^2$
(d) $(m^2 + n^2)^2 = m^2n^2$

Q51. If base and hypotenuse of a right triangle are $(u^2 - v^2)$ and $(u^2 + v^2)$ respectively and the area of the triangle is 2016 square units, then the perimeter of the triangle may be

(a) 224 units
(b) 288 units
(c) 448 units
(d) 576 units

defence.adda247.com
Prepare for Defence Exams

Q52. A circle is inscribed in an equilateral triangle of side of length l. The area of any square inscribed in the circle is

(a) $\frac{l^2}{2}$

(b) $\frac{\sqrt{3}\,l^2}{4}$

(c) $\frac{l^2}{4}$

(d) $\frac{l^2}{6}$

Q53. Walls (excluding roofs and floors) of 5 identical rooms having length, breadth and height 6 m, 4m and 2.5 m respectively are to be painted. Out of five rooms, two rooms have one square window each having a side of 2.5 m. Paints are available only in cans of 1 litre; and 1 litre of paint can be used for painting 20 square metres. The number of cans required for painting is

(a) 10

(b) 12

(c) 13

(d) 14

Q54. Let S be the parallelogram obtained by joining the mid-points of the parallelogram T. Consider the following statements:

1. The ratio of area of T to that of S is 2 : 1.
2. The perimeter of S is half of the sum of diagonals of T.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

Q55. The sides of a triangle are 5 cm, 6 cm and 7 cm. The area of the triangle is approximately

(a) 14.9 cm^2

(b) 14.7 cm^2

(c) 14.5 cm^2

(d) 14.3 cm^2

Q56. There are n zeros appearing immediately after the decimal point in the value of $(0.2)^{25}$. It is given that the value of $\log_{10} 2 = 0.30103$. The value of n is

(a) 25

(b) 19

(c) 18

(d) 17

defence.adda247.com
Prepare for Defence Exams

Q57. The ratio of the sum and difference of the ages of the father and the son is 11 : 3. Consider the following statements:

1. The ratio of their ages is 8 : 5.
2. The ratio of their ages after the son attains twice the present age will be 11 : 8.

Which of the statements given above is/are correct ?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Q58. The solution of linear inequalities x + y ≥ 5 and x – y ≤ 3 lies

(a) Only in the first quadrant
(b) In the first and second quadrants
(c) In the second and third quadrants
(d) In the third and fourth quadrants

Q59. It is given that the equations $x^2 - y^2 = 0$ and $(x - a)^2 + y^2 = 1$ have single positive solution. For this, the value of 'a' is

(a) $\sqrt{2}$
(b) 2
(c) $-\sqrt{2}$
(d) 1

Q60. If α, β and λ are the zeros of the polynomial f(x) = $ax^3 + bx^2 + cx + d$, then $\alpha^2 + \beta^2 + \lambda^2$ is equal to

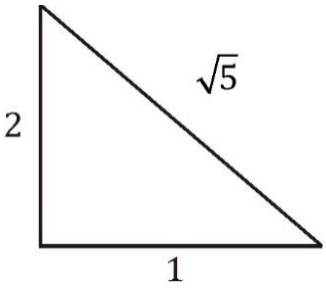
(a) $\frac{b^2-ac}{a^2}$
(b) $\frac{b^2-2ac}{a}$
(c) $\frac{b^2+2ac}{b^2}$
(d) $\frac{b^2-2ac}{a^2}$

defence.adda247.com
Prepare for Defence Exams

SOLUTIONS

S41. Ans.(b)

Sol.



$\cos\theta = \frac{1}{\sqrt{5}}$

$\Rightarrow \tan\theta = \frac{2}{1} = 2$

Consider,

$\frac{2\tan\theta}{1-\tan^2\theta}$

$\frac{2\times2}{1-2^2} = \frac{4}{1-4} = -\frac{4}{3}$

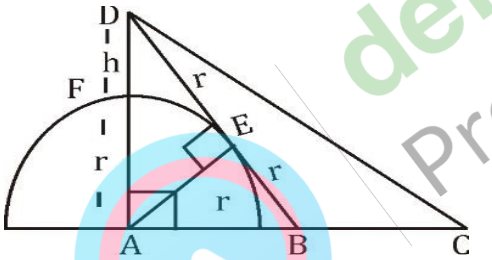
S42. Ans.(b)

Sol.

$\theta > \phi$.

S43. Ans.(a)

Sol.



Let AE = r

Given that after moving a distance d toward the dome, when the flag is just visible, the elevation is 45°

∴ DB is tangent

And ∠ D B A = 45°

∵ DB is tangent and AE is radius

∴ ∠ B E A = ∠ DEA = 90°

⇒ ∠ E A B = 45°

⇒ AE = BE = r

[∠ E A B = ∠ E B A = 45°]

∵ ∠ D A B = 90° & ∠ E A B = 45°

⇒ ∠ D A E = 45°

⇒ ∠ ADE = 45°

⇒ AE = DE = r

defence.adda247.com
Prepare for Defence Exams

In Δ DAB

$\tan 45° = \frac{h+r}{AB}$

$\Rightarrow$ AB = h + r

Again in triangle DAB, By Pythagoras.

$(2r)^2 = (h+r)^2 + (h+r)^2$

$4r^2 = 2(h+r)^2$

$2r^2 = (h+r)^2$

$h + r = \sqrt{2}\, r$

$h = r\left(\sqrt{2} - 1\right)$

$\frac{h}{r} = \sqrt{2} - 1$

S44. Ans.(c)

Sol.

$Sin\ (A+B) = \frac{\sqrt{3}}{2}$

Sin (A + B) = Sin 60°

A + B = 60° _____(1)

$\Rightarrow$ A = 30°

Cos B = $\frac{\sqrt{3}}{2}$

Cos B = cos 30°

B = 30° _____(2)

$\tan(2A - B) = \tan(60 - 30°) = \tan 30° = \frac{1}{\sqrt{3}}$

S45. Ans.(c)

Sol. 1.

$\frac{\cos\theta}{1-\sin\theta} + \frac{\cos\theta}{1+sin\theta} = 4$

$\Rightarrow \frac{\cos\theta(1+\sin\theta)+\cos\theta(1-\sin\theta)}{1-\sin^2\theta} = 4$

$\Rightarrow \frac{\cos\theta+\sin\theta\ cos\theta+\cos\theta-\sin\theta\cos\theta}{\cos^2\theta} = 4$

$\Rightarrow \frac{2}{\cos\theta} = 4$

$\Rightarrow$ sec θ = 2

$\Rightarrow$ sec θ = sec 60°

$\Rightarrow$ θ = 60°

2. 3 tan θ + cot θ = 5 cosec θ.

$\frac{3}{\cot\theta} + \cot\theta = 5\ cosec\ \theta.$

$3 + \cot^2\theta = 5\ cosec\ \theta \cot\theta.$

$2 + cosec^2\theta = 5\ cosec\ \theta \cot\theta.$

$2\sin^2\theta + 1 = 5\cos\theta$

$2 - 2\cos^2\theta + 1 = 5\cos\theta.$

$2\cos^2\theta + 5\cos\theta - 3 = 0.$

Solving quadratic equation for cos θ, we get

Cos θ = $\frac{1}{2}$, $\cos\theta = -3\ (neglecting)$

$\Rightarrow$ cos θ = cos 60°

$\Rightarrow$ θ = 60°

defence.adda247.com
Prepare for Defence Exams

S46. Ans.(c)

Sol. 1. We know that $\cos^2\theta$ is defined in [0, 1] so

$\cos^2\theta = 1 - \frac{p^2+q^2}{2pq}$, where p, q are non zero real numbers, is possible only when p = q.

2. We know that $\tan^2\theta$ is defined in [0, ∞]. So $\tan^2\theta = \frac{4pq}{(p+q)^2} - 1$, where p, q are non zero real numbers, is possible only when p = q.

S47. Ans.(c)

Sol. 1. If possible, let cos x + sec x = $\frac{3}{2}$

$\therefore \cos x + \frac{1}{\cos x} = \frac{3}{2}$

$\Rightarrow 2\cos^2 x + 2 = 3\cos x$

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

Solving it as a quadratic in cos x, we get

Cos x = $\frac{3\pm\sqrt{9-16}}{4} = \frac{3\pm\sqrt{-7}}{4}$

Both of these values of cos x are imaginary and hence both these values are impossible as cos x is always real.

$\therefore$ cos x + sec x can never be equal to $\frac{3}{2}$.

2. $\sec^2\theta + cosec^2\theta$

$\frac{1}{\sin^2\theta\cos^2\theta}$

$\frac{4}{4\sin^2\theta\cos^2\theta}$

$\frac{4}{(\sin 2\theta)^2}$

This expression is less than 4 if

Sin 2θ > 1 but it not possible as.

$\sin^2\theta$ *lies in* [0, 1].

S48. Ans.(c)

Sol. $\cos^{12}x + 3\cos^{10}x + 3\cos^8 x + \cos^6 x$

$= \sin^6 x + 3\sin^5 x + 3\sin^4 x + \sin^3 x$

$= [(\sin^2 x)^3 + (\sin x)^3] + 3\sin^3 x[\sin^2 x + \sin x]$

$= (\sin^2 x + \sin x)(\sin^4 x + \sin^2 x - \sin^3 x) + 3\sin^3 x$

$= \sin^4 x + \sin^2 x + 2\sin^3 x$

$= [(\sin^2 x)^2 + (\sin x)^2] + 2\sin^3 x$

$= (\sin^2 x + \sin x)^2 - 2\sin^3 x + 2\sin^3 x = 1$

S49. Ans.(d)

Sol. Given,

$(3\sin\theta + 5\cos\theta) = 4$

Squaring both sides,

$9\sin^2\theta + 25\cos^2\theta + 30\cos\theta\sin\theta = 16.$

$9\sin^2\theta + 9\cos^2\theta + 16\cos^2\theta + 30\cos\theta\sin\theta = 16.$

$9 + 16\cos^2\theta + 30\cos\theta\sin\theta = 16.$

$30\cos\theta\ \sin\theta = 16 - 9 - 16\cos^2\theta$ ____(1)

defence.adda247.com
Prepare for Defence Exams

Now,

$(3 \cos \theta - 5 \sin \theta)^2$

$= 9 \cos^2 \theta + 25 \sin^2 \theta - 30 \sin \theta \cos \theta$

$= 9 \cos^2 \theta + 9 \sin^2 \theta + 16 \sin^2 \theta - 30 \sin \theta \cos \theta$

$= 9 + 16 \sin^2 \theta - 16 + 9 + 16 \cos^2 \theta$ [from (1)]

$= 18 + 16 - 16 = 18$

S50. Ans.(b)

Sol. Put $\theta = 45°$, we get

$m = \frac{\sqrt{2}+1}{4\sqrt{2}}$ and $n = \frac{\sqrt{2}-1}{4\sqrt{2}}$

R.H.S

$mn = \frac{(\sqrt{2}+1)}{4\sqrt{2}} \frac{(\sqrt{2}-1)}{4\sqrt{2}} = \frac{2-1}{32} = \frac{1}{32}$

L.H.S $(m^2 - n^2)^2$

$$\left[\left(\frac{\sqrt{2}+1}{4\sqrt{2}}\right)^2 - \left(\frac{\sqrt{2}-1}{4\sqrt{2}}\right)^2\right]^2 = \left[\frac{3+2\sqrt{2}}{32} - \frac{(3-2\sqrt{2})}{32}\right]^2$$

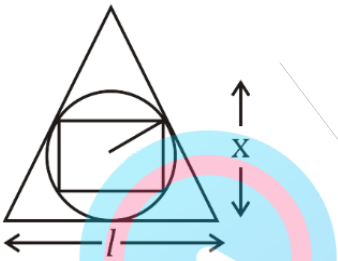
$$= \left(\frac{3+2\sqrt{2}-3+2\sqrt{2}}{32}\right)^2 = \left(\frac{4\sqrt{2}}{32}\right)^2 = \left(\frac{\sqrt{2}}{8}\right)^2 = \left(\frac{1}{4\sqrt{2}}\right)^2 = \frac{1}{32}$$

L. H. S = R. H. S.

S51. Ans.(b)

S52. Ans.(d)

Sol.



Side of equilateral $\Delta = \ell$

Then,

Inradius of circle $= \frac{\ell}{2\sqrt{3}}$

$\therefore$ indiameter of circle $= \frac{\ell}{\sqrt{3}}$

which is diagonal of the square inscribe in the circle

Let, side of square = x

Then,

$x^2 + x^2 = \left(\frac{\ell}{\sqrt{3}}\right)^2$

$2x^2 = \frac{\ell^2}{3}$

Area of square, $x^2 = \frac{\ell^2}{6}$

defence.adda247.com
Prepare for Defence Exams

S53. Ans.(b)

Sol. ℓ = 6m, b = 4m, h = 2.5m

Area of 4 walls = 2h(ℓ +b)

= 2 × 2.5 (6 + 4)

= 5(10) = 50m^2

Area of 3 rooms without window = 50 × 3 = 150 m^2

Area of 2 rooms with windows = 2 (50 – 6.25)

= 2 (43.75) = 87.5m^2

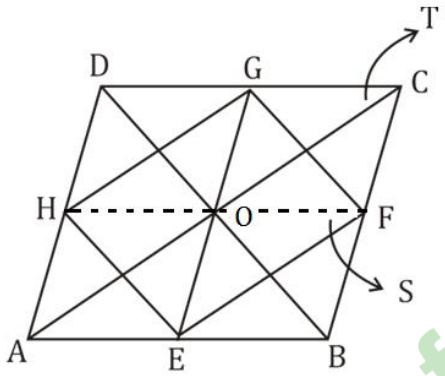
Total area to be painted = 150 + 87.5 = 237.5m^2

No. of cans required $= \frac{237.5}{20}$

= 11.875 ≃ 12 cans

S54. Ans.(c)

Sol.



Statement 1.

In quadrilateral AEOH

He is diagonal

So, Ar. $\Delta HEO = \frac{1}{2}$ ar AEOH

Similarly, = Ar HEFG $= \frac{1}{2}$ ar ABCD

So, it is correct.

Statement 2.

In ΔABD and ΔAEH

$\frac{AE}{AB} = \frac{HE}{BD}$

$\Rightarrow \frac{HE}{BD} = \frac{1}{2}$

$\Rightarrow HE = \frac{BD}{2}$

Similarly, HE + EF + FG + GH

$= \frac{BD}{2} + \frac{AC}{2} + \frac{BD}{2} + \frac{AC}{2}$

⇒ Perimeter HEFG = BD + AC

So, it is also correct

defence.adda247.com
Prepare for Defence Exams

S55. Ans.(b)

Sol. a = 5 cm, b = 6 cm, c = 7cm

Semi-perimeter, $S = \frac{a+b+c}{2} = \frac{5+6+7}{2}$

Area of triangle $= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{9 \times 4 \times 3 \times 2} = \sqrt{3 \times 3 \times 2 \times 2 \times 3 \times 2}$

$= 6\sqrt{6} = 6 \times 2.449 = 14.694 \simeq 14.7\ cm^2$

S56. Ans.(d)

S57. Ans.(b)

Sol. Let age of father and son be 'F' and 'S' resp.

ATQ,

$\frac{F+S}{F-S} = \frac{11}{3}$

3F + 3S = 11F – 11S

14S = 8F

$\Rightarrow \frac{F}{S} = \frac{7}{4}$

Statement 1.

Ratio of their ages = 7 : 4

So, it is incorrect

Statement 2.

Let son, s age = 4 years and father's age = 7 years

ATQ,

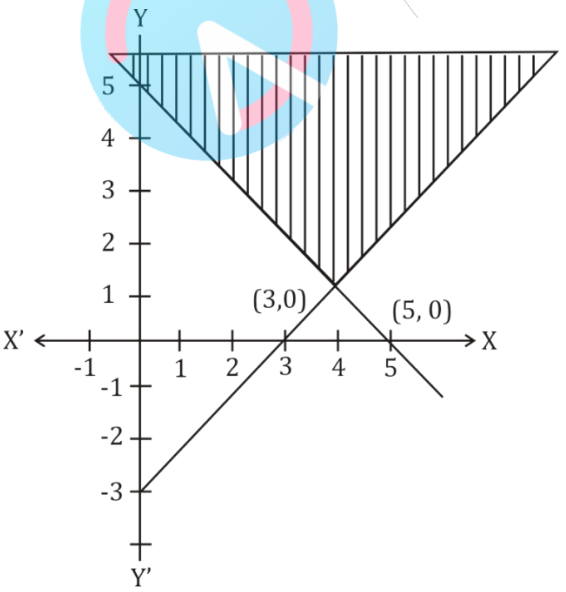
When son's age= 8 yrs

Then father's age = 11 yrs

So, it is correct

S58. Ans.(b)

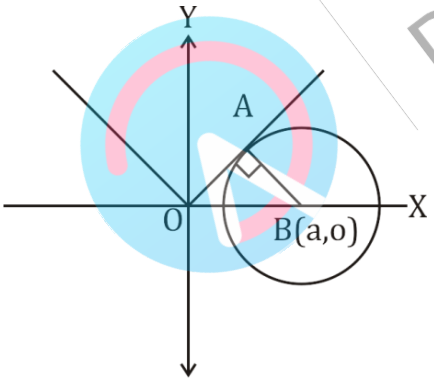
Sol.



defence.adda247.com
Prepare for Defence Exams

$x + y \geq 5$
let first draw graph of $x + y = 5$ ...(1)
put $y = 0$ in (1)
$x = 5$
put $x = 0$ in (1)
$y = 5$
Checking for (0, 0)
$x + y \geq 5$
$0 \geq 5$, which is false
Hence, origin does not lie in $x + y \geq 5$
Now,
$x - y \leq 3$
let first drawn graph of $x - y = 3$ ...(2)
put $x = 0$ in (2)
$y = -3$
put $y = 0$ in (2)
$x = 3$
Checking for (0, 0)
$x - y \leq 3$
$0 \leq 3$, which is true
Hence, origin lies in $x - y \leq 3$
So, shaded region will be the solution of these linear inequalities lies in the first and second quadrant.

S59. Ans.(a)
Sol. $x^2 - y^2 = 0$ (Equation of $y = |x|$)
$(x - a)^2 + y^2 = 1$ [Equation of a circle with centre (a, 0) and radius 1]
These have single positive solution
$\Rightarrow y = |x|$ to be tangent to the circle



AB = radius of circle
$\angle AOB = 45°$
$\angle OAB = 90°$ [tangent to the circle]
$\angle ABO = 45°$
Length of $OB = \sqrt{AB^2 + OA^2}$
$= \sqrt{1^2 + 1^2}$
$OB = \sqrt{2}$

defence.adda247.com
Prepare for Defence Exams

S60. Ans.(d)

Sol.

$f(x) = ax^3 + bx^2 + cx + d$ ...(1)

α, β, γ are the zeroes of f(x)

Then,

$\alpha + \beta + \gamma = -\frac{b}{a}$ ...(2)

$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$ ...(3)

Squaring (ii), we get

$\alpha^2 + \beta^2 + \gamma^2 + 2(\alpha\beta + \beta\gamma + \gamma\alpha) = \frac{b^2}{a^2}$

$\alpha^2 + \beta^2 + \gamma^2 + \frac{2c}{a} = \frac{b^2}{a^2}$ [From (3)]

$\alpha^2 + \beta^2 + \gamma^2 = \frac{b^2}{a^2} - \frac{2c}{a}$

$= \frac{b^2 - 2ac}{a^2}$

defence.adda247.com
Prepare for Defence Exams