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OAVS TGT Math Previous Year Question FREE DEMO

**10 Toughest Subject Content Questions (2017 – 2024) with Full
Solutions**



SUBJECT CONTENT – 10 TOUGHEST PYQ

Hand-picked from 7 OAVS TGT Math papers (2017, 2019, 2021 1st & 2nd Shift, 2023, 2024 and OMAV 2024) – with the same step-by-step solutions you get in the full pack.

Q-1 One real root of the equation $x^3 + x - 5 = 0$ lies in the interval.

[OAVS TGT Math 2017]

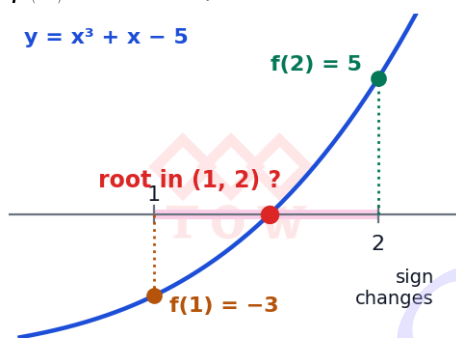
- (A) $(-3, -2)$
- (B) $(2, 3)$
- (C) $(1, 2)$
- (D) $(3, 4)$

ANS- (C) $(1, 2)$

Given:

→ $f(x) = x^3 + x - 5$; need the interval where $f(x) = 0$

$$y = x^3 + x - 5$$



Concept:

→ Intermediate value (sign-change) rule: if $f(a)$ and $f(b)$ have opposite signs, a real root lies between a and b

Solution:

- Put $x=1$: $f(1) = 1 + 1 - 5 = -3$ (negative)
- Put $x=2$: $f(2) = 8 + 2 - 5 = 5$ (positive)
- Sign changes from $-$ to $+$ between $x=1$ and $x=2$
- ⇒ One real root lies in $(1, 2)$

∴ Ans: (C) $(1, 2)$

Hint:

→ Check others: $f(2)=5$ and $f(3)=25$ are both positive (no change in $(2, 3)$);
 $f(-3)=-35$, $f(-2)=-15$ both negative (no change in $(-3, -2)$)

Q-2 If the angle A of a triangle ABC is given by the equation

$3 \cos A + 2 = 0$, $\sin A$ and $\tan A$ are the roots of the equation:

[OAVS TGT Maths 2019]

- (A) $6x^2 - \sqrt{5}x + 5 = 0$
- (B) $6x^2 + \sqrt{5}x - 5 = 0$
- (C) $6x^2 + 5\sqrt{5}x - 5 = 0$
- (D) $6x^2 - 5\sqrt{5}x + 5 = 0$

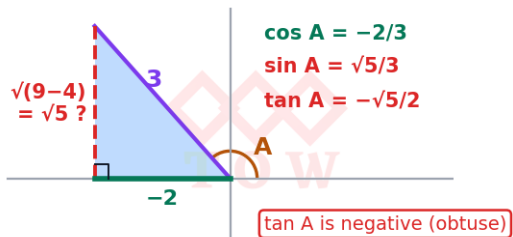


Ans- (B) $6x^2 + \sqrt{5}x - 5 = 0$

Given:

→ $3 \cos A + 2 = 0$ in a triangle

→ $\Rightarrow \cos A = -\frac{2}{3}$, so A is obtuse



Concept:

→ Quadratic with roots α, β : $x^2 - (\alpha + \beta)x + \alpha\beta = 0$

Solution:

➤ $\sin A = \frac{\sqrt{5}}{3}$, $\tan A = -\frac{\sqrt{5}}{2}$

➤ $\sum = \frac{\sqrt{5}}{3} - \frac{\sqrt{5}}{2} = -\frac{\sqrt{5}}{6}$, $Product = -\frac{5}{6}$

➤ $x^2 + \frac{\sqrt{5}}{6}x - \frac{5}{6} = 0$

$\Rightarrow 6x^2 + \sqrt{5}x - 5 = 0$

➤ **Ans:** (B) $6x^2 + \sqrt{5}x - 5 = 0$

Hint:

→ $\sin A$ is always positive in a triangle; the sign of $\cos A$ decides whether $\tan A$ is negative

Q-3 The value of $\int_0^{\pi/2} \frac{x}{\sin x + \cos x} dx = ?$

[OAVS TGT Maths 2019]

(A) $\frac{\pi}{2\sqrt{2}} \log|\sqrt{2}+1|$

(B) 0

(C) $\frac{\pi}{2\sqrt{2}} \log|\sqrt{2}-1|$

(D) $\frac{\pi}{2\sqrt{2}} \log|\sqrt{2}+2|$

Ans- (A) $\frac{\pi}{2\sqrt{2}} \log|\sqrt{2}+1|$

Given:



$$\rightarrow I = \int_0^{\pi/2} \frac{x}{\sin x + \cos x} dx$$

Concept:

$$\rightarrow \text{Property: } \int_0^a f(x) dx = \int_0^a f(a-x) dx$$

Solution:

$$\rightarrow \text{Replacing } x \text{ by } \frac{\pi}{2} - x \text{ and adding: } 2I = \frac{\pi}{2} \int_0^{\pi/2} \frac{dx}{\sin x + \cos x}$$

$$\rightarrow \sin x + \cos x = \sqrt{2} \sin\left(x + \frac{\pi}{4}\right), \text{ so the integral} = \sqrt{2} \log(\sqrt{2} + 1)$$

$$\Rightarrow I = \frac{\pi}{2\sqrt{2}} \log(\sqrt{2} + 1)$$

$$\rightarrow \text{Ans: (A) } \frac{\pi}{2\sqrt{2}} \log(\sqrt{2} + 1)$$

Hint:

$\rightarrow \sin x$ and $\cos x$ swap under $x \rightarrow \pi/2 - x$, which removes the x in the numerator

Q-4 If $10 \sin^4 x + 15 \cos^4 x = 6$, then the value of $81 \operatorname{cosec}^8 x + 8 \tan^6 x$ is:

[OAVS TGT MATH 2021 1st Shift]

- (A) 638
(B) 625
(C) 652
(D) 648

ANS- (C) 652

Given:

$$\rightarrow 10 \sin^4 x + 15 \cos^4 x = 6$$

Concept:

$$\rightarrow \sin^2 x + \cos^2 x = 1$$

Solution:

$$\rightarrow \text{Put } \sin^2 x = t, \cos^2 x = 1 - t$$

$$\Rightarrow 10t^2 + 15(1-t)^2 = 6$$

$$\Rightarrow 25t^2 - 30t + 9 = 0$$

$$\Rightarrow (5t-3)^2 = 0$$

$$\Rightarrow t = \frac{3}{5}; \sin^2 x = \frac{3}{5}, \cos^2 x = \frac{2}{5}$$

$$\rightarrow \operatorname{cosec}^2 x = \frac{5}{3}, \tan^2 x = \frac{\frac{3}{5}}{\frac{2}{5}} = \frac{3}{2}$$

$$\rightarrow 81 \operatorname{cosec}^8 x = 81 \times \frac{625}{81} = 625$$

$$\rightarrow 8 \tan^6 x = 8 \times \frac{27}{8} = 27$$



$$\Rightarrow \text{Sum} = 625 + 27 = 652$$

► Ans: (C) 652

Hint:

$$\rightarrow \text{If } a \sin^4 x + b \cos^4 x = \frac{ab}{a+b}, \text{ then } \sin^2 x = \frac{b}{a+b} \text{ and } \cos^2 x = \frac{a}{a+b}$$

Q-5 From the top and foot of a 10 m high pole, the angles of elevation of the top of a tower are 30° and 60° respectively. What is the height of the tower?

[OAVS TGT MATH 2021]

(A) 10 m

(B) 20 m

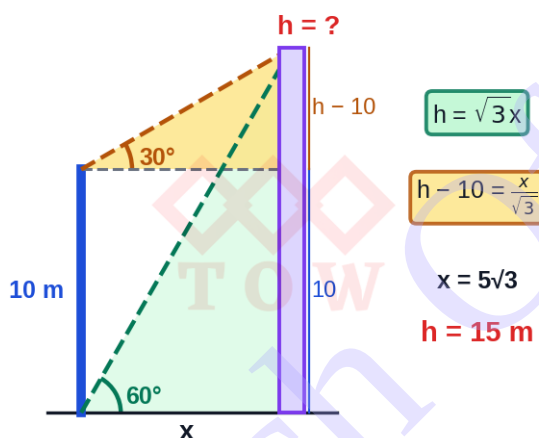
(C) 12 m

(D) 15 m

ANS- (D) 15 m

Given:

→ Pole = 10 m; angle from its top = 30° , from its foot = 60°



Concept:

→ Let tower height = h and distance = x ; $\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$

Solution:

► From the foot: $\tan 60^\circ = \frac{h}{x}$, so $h = \sqrt{3}x$

⇒ From the top: $\tan 30^\circ = \frac{h-10}{x}$, so $h-10 = \frac{x}{\sqrt{3}}$

$$\Rightarrow \sqrt{3}x - \frac{x}{\sqrt{3}} = 10, \text{ so } \frac{2x}{\sqrt{3}} = 10$$

$$\Rightarrow x = 5\sqrt{3}$$

$$\Rightarrow h = \sqrt{3} \times 5\sqrt{3} = 15 \text{ m}$$

► Ans: (D) 15 m

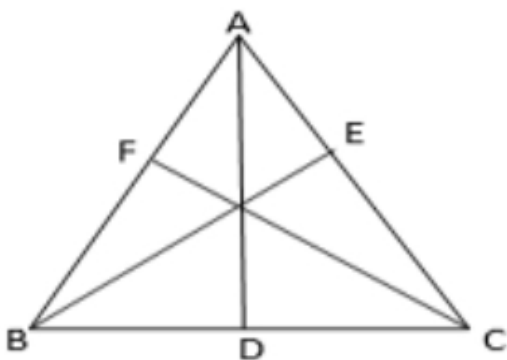
Hint:

$$\rightarrow \text{Shortcut: } h = \frac{10 \times \tan 60^\circ}{\tan 60^\circ - \tan 30^\circ} = 15 \text{ m}$$



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Q-6 Three concurrent straight lines are drawn from the angular points A, B and C of the triangle ABC to meet the opposite sides at D, E and F , respectively, as shown in the figure below. It is given that $AF:FB=2:3$ and $BD:DC=3:5$. Find $AE:EC$?



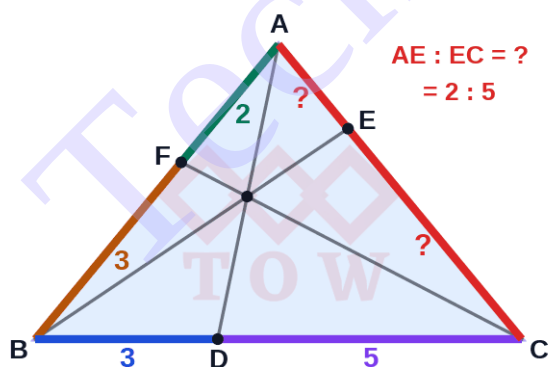
[OAVS TGT MATH 2023]

- (A) 4:5
- (B) 3:4
- (C) 2:5
- (D) 5:2

Ans- (C) 2:5

Given:

→ $AF : FB = 2 : 3$, $BD : DC = 3 : 5$; AD, BE, CF are concurrent



$$\text{Ceva: } \frac{AF}{FB} \cdot \frac{BD}{DC} \cdot \frac{CE}{EA} = 1$$

Concept:

→ Ceva's theorem: $\frac{AF}{FB} \cdot \frac{BD}{DC} \cdot \frac{CE}{EA} = 1$

Solution:

$$\rightarrow \frac{2}{3} \cdot \frac{3}{5} \cdot \frac{CE}{EA} = 1$$

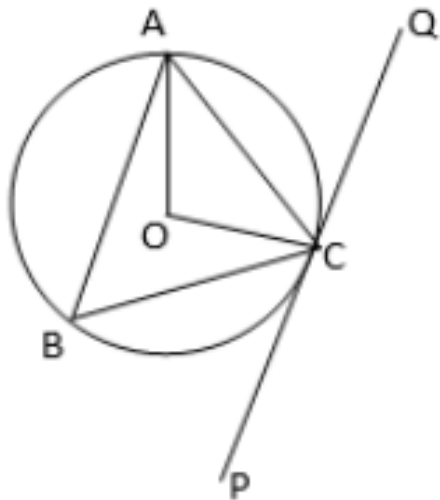


$$\Rightarrow \frac{CE}{EA} = \frac{5}{2}$$

$$\Rightarrow AE : EC = 2 : 5$$

► Ans: (C) 2 : 5

Q-7 In the given figure, O is the centre of the circle. If $\angle OAC = 30^\circ$, the acute angle between AC and the tangent PQ at C is:



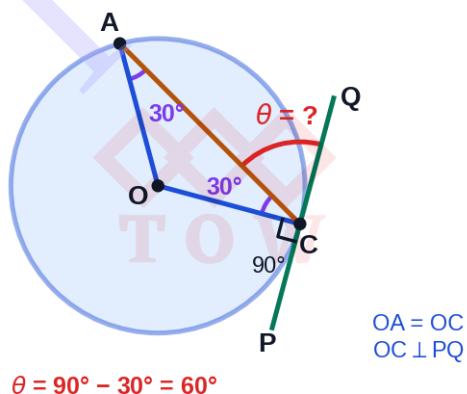
[OAVS TGT MATH 2023]

- (A) 30°
- (B) 60°
- (C) 90°
- (D) 45°

Ans- (B) 60°

Given:

→ O is the centre, $\angle OAC = 30^\circ$, PQ is the tangent at C



Concept:

→ $OA = OC$ (radii); radius $\perp$ tangent at the point of contact



Solution:

- $\angle OCA = \angle OAC = 30^\circ$
- $\Rightarrow \angle OCQ = 90^\circ$
- $\Rightarrow$ Angle between AC and PQ $= 90^\circ - 30^\circ = 60^\circ$
- Ans: (B) 60°

Q-8 Twelve spherical Rasagullas of diameter 4 cm each are packed in a cylindrical tin of radius 5 cm and height 8 cm. Sugar syrup is poured into the tin such that 1 cm from the top of the tin is left empty. The volume of sugar syrup poured is _____ cm^3 .

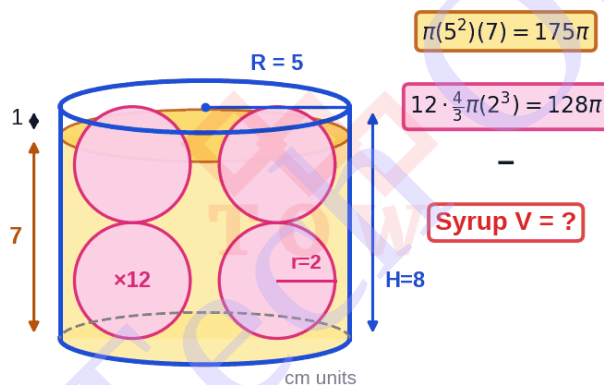
[OMAV TGT MATH 2024]

- (A) 47π
- (B) 143π
- (C) 36π
- (D) 72π

ANS- (A) 47π

Given:

- 12 spheres, diameter 4 cm ($r=2$ cm)
- Cylinder: $R=5$ cm, $H=8$ cm; syrup up to $8-1=7$ cm



Concept:

- Syrup volume = cylinder volume up to 7 cm – volume of spheres

Solution:

- Cylinder part $= \pi \times 5^2 \times 7 = 175\pi$
- Spheres $= 12 \times \frac{4}{3} \pi \times 2^3 = 128\pi$
- Syrup $= 175\pi - 128\pi = 47\pi \text{ cm}^3$
- Ans: (A) 47π

Q-9 In $\triangle ABC$, $AB=5$ cm, $BC=6$ cm and $CA=7$ cm. A transversal is drawn to cut the sides AB at F , BC produced at D and CA at E so that $AF=2$ cm and $AE=4$ cm. Find the length of BD .



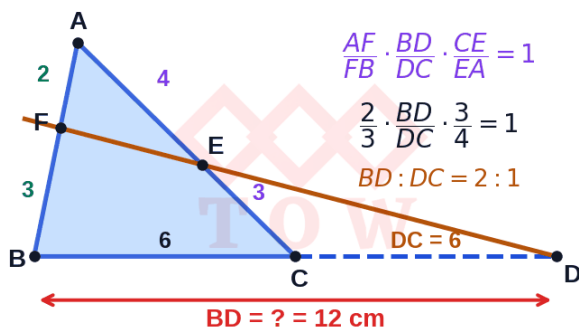
[OAVS TGT MATH 2024]

- (A) 12 cm
(B) 9 cm
(C) 7 cm
(D) 8 cm

ANS- (A) 12 cm

Given:

→ AB = 5, BC = 6, CA = 7 cm; AF = 2 cm, AE = 4 cm; D on BC produced



Concept:

→ Menelaus' theorem: $\frac{AF}{FB} \times \frac{BD}{DC} \times \frac{CE}{EA} = 1$

Solution:

► FB = 5 - 2 = 3 cm, EC = 7 - 4 = 3 cm

$$\Rightarrow \frac{2}{3} \times \frac{BD}{DC} \times \frac{3}{4} = 1, \text{ so } \frac{BD}{DC} = 2$$

⇒ D lies beyond C, so DC = BD - 6

$$\Rightarrow BD = 2(BD - 6), \text{ so } BD = 12 \text{ cm}$$

► Ans: (A) 12 cm

Hint:

→ Check: DC = 6 cm, and BD : DC = 12 : 6 = 2 : 1.

Q-10 Consider the basis $S = \{\alpha_1, \alpha_2, \alpha_3\}$ of R^3 , where $\alpha_1 = (1, 1, 1)$, $\alpha_2 = (1, 1, 0)$ and $\alpha_3 = (1, 0, 0)$. If $T: R^3 \rightarrow R^2$ is defined as $T(\alpha_1) = (1, 0)$, $T(\alpha_2) = (2, -1)$ and $T(\alpha_3) = (4, 3)$, then find $T(2, -3, 5)$.

[OAVS TGT MATH 2024]

- (A) (9, 23)
(B) (25, 5)
(C) (7, 2)
(D) (5, -8)

ANS- (A) (9, 23)

Given:





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→ $\alpha_1 = (1, 1, 1)$, $\alpha_2 = (1, 1, 0)$, $\alpha_3 = (1, 0, 0)$; $T(\alpha_1) = (1, 0)$, $T(\alpha_2) = (2, -1)$, $T(\alpha_3) = (4, 3)$

Concept:

→ Write $(2, -3, 5)$ in terms of the basis, then use linearity.

Solution:

➤ $(2, -3, 5) = x\alpha_1 + y\alpha_2 + z\alpha_3 = (x + y + z, x + y, x)$

⇒ $x = 5$, $y = -8$, $z = 5$

⇒ $T(2, -3, 5) = 5(1, 0) - 8(2, -1) + 5(4, 3)$

⇒ $(5 - 16 + 20, 0 + 8 + 15) = (9, 23)$

➤ Ans: (A) $(9, 23)$

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