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Class: 9
Subject: Mathematics
Topic: SA1
No. of Questions: 30

Q1. If $\frac{3+2\sqrt{2}}{3-\sqrt{2}} = a + b\sqrt{2}$, where a and b are rational then find the values of a and b.

(a) $a = \frac{3}{4}, b = \frac{1}{2}$
(b) $a = 5, b = 7$
(c) $a = \frac{4}{7}, b = \frac{9}{4}$
(d) $a = \frac{13}{7}, b = \frac{9}{7}$

Sol. (d)

L.H.S. $\frac{3+2\sqrt{2}}{3-\sqrt{2}} = \frac{(3+2\sqrt{2})(3+\sqrt{2})}{(3-\sqrt{2})(3+\sqrt{2})}$

$= \frac{9+3\sqrt{2}+6\sqrt{2}+4}{9-2}$

$= \frac{13+9\sqrt{2}}{7}$

$= \frac{13}{7} + \frac{9}{7}\sqrt{2}$

$= \frac{13}{7} + \frac{9}{7}\sqrt{2} = a + b\sqrt{2}$

Equating the rational and irrational parts

We get a = $\frac{13}{7}, b = \frac{9}{7}$

Q2. If $\sqrt{3} = 1.732$, find the value of $\frac{1}{\sqrt{3}-1}$

(a) 1.256
(b) 1.367
(c) 1.366
(d) 2.366

Sol. (c)

$= \frac{1}{\sqrt{3}-1} = \frac{1}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$

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$= \frac{\sqrt{3}+1}{2}$

$= \frac{1.732+1}{2}$

$= \frac{2.732}{2}$

$= 1.366$

Q3. If = $\frac{1}{2+\sqrt{3}} =$ find the values of $x^3 - x^2 - 11x + 3$.

(a) 1
(b) 3
(c) 0
(d) 2

Sol. (c)

As, $x = \frac{1}{2+\sqrt{3}} = 2 - \sqrt{3}$

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

$\Rightarrow (x-2)^2 = \left(-\sqrt{3}\right)^2$ [By squaring both sides]

$\Rightarrow x^2 + 4 - 4x = 3$

$\Rightarrow x^2 - 4x + 1 = 0$

Now, $x^3 - x^2 - 11x + 3 = x^3 - 4x^2 + x + 3x^2 - 12x + 3$

$= x(x^2 - 4x + 1) + 3(x^2 - 4x + 1)$

$= x(0) + 3(0)$

= 0 + 0 = 0

Q4. If x = $3 - \sqrt{8}$, *find the value of* $x^3 + \frac{1}{x^3}$

(a) 196
(b) 197
(c) 195

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(d) 198

Sol. (d)

Sol. $x = 3 - \sqrt{8}$

$\therefore \ \frac{1}{x} = \frac{1}{3-\sqrt{8}}$

$\Rightarrow \frac{1}{x} = 2 + \sqrt{8}$

Now, $x + \frac{1}{x} = 3 - \sqrt{8} + 3 + \sqrt{8} = 6$

$\Rightarrow x^3 + \frac{1}{x^3} = \left(x + \frac{1}{x}\right)^3 - 3x\frac{1}{x}\left(x + \frac{1}{x}\right)$

$\Rightarrow x^3 + \frac{1}{x^3} = (6)^2 - 3(6)$

$\Rightarrow x^3 + \frac{1}{x^3} = 216 - 18$

$\Rightarrow x^3 + \frac{1}{x^3} = 198$

Q5. Simplify: $\frac{(a^2-b^2)^3+(b^2-c^2)^3+(c^2-a^2)^3}{(a-b)^3+(b-c)^3+(c-a)^3}$

(a) $(a+b)(b+c)(c-a)$
(b) $(a+b)(b+c)(c+a)$
(c) $(a-b)(b-c)(c-a)$
(d) $(a-b)(b-c)(c+a)$

Sol. (b)

Here $(a^2-b^2)+(b^2-c^2)^3+(c^2-a^2)=0$

$\therefore \ (a^2-b^2)^3+(b^2-c^2)^3+(c^2-a^2)^3 = 3(a^2-b^2)(b^2-c^2)(c^2-a^2)$

Also, $(a-b)+(b-c)+(c-a)=0$

$\therefore \ (a-b)^3+(b-c)^3+(c-a)^3 = 3(a-b)(b-c)(c-a)$

$\therefore$ Given expression $= \frac{3(a-b)(a+b)(b-c)(b+c)(c-a)(c+a)}{3(a-b)(b-c)(c-a)}$

$= \frac{3(a-b)(a+b)(b-c)(b+c)(c-a)(c+a)}{3(a-b)(b-c)(c-a)}$

$= (a+b)(b+c)(c+a)$ **Ans.**

Q6. If $a + b + c = 9$ *and* $ab + bc + ca = 26$, *find the value of* $a^3 + b^3 + c^3 - 3abc$

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(a) 26
(b) 25
(c) 27
(d) 24

Sol. (c)

We have $a + b + c = 9$ ...(i)

$\Rightarrow (a + b + c)^2 = 81$ [On squaring both sides of (i)]

$\Rightarrow a^2 + b^2 + c^2 + 2(ab + bc + ac) = 81$

$\Rightarrow a^2 + b^2 + c^2 + 2 \times 26 = 81$ [$\because ab + bc + ac = 26$]

$\Rightarrow a^2 + b^2 + c^2 = (81 - 52)$

$\Rightarrow a^2 + b^2 + ^2 = 29.$

Now, we have

$a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ac)$

$= (a + b + c)[(a^2 + b^2 + c^2) - (ab + bc + ac)]$

$= 9 \times [(29 - 26)]$

$= (9 \times 3)$

$= 27$ **Ans.**

Q7. If x = 2 & x = 0 are two roots of the polynomial f(x) = $2x^3 - 5x^2 + ax + b$. Find the values of a And b

(a) $a = 2, b = 0$
(b) $a = -3, b = 4$
(c) $a = 1, b = -4$
(d) $a = 3, b = 2$

Sol. (a)

$f(x) = 2(2)^3 - 5(2)^2 + a(2) + b = 0$

$\Rightarrow 16 - 20 + 2a + b = 0$

$\Rightarrow 2a + b = 4$ ....(i)

$\Rightarrow f(0) = 2(0)^3 - 5(0)^2 + a(0) + b = 0$

$\Rightarrow b = 0$

So, $2a = 4$

Hence, $a = 2, b = 0$ **Ans.**

Q8. Find the remainder when f(x) = $x^3 - 6x^2 + 2x - 4$ is divisible by g(x) = 1-2x.

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(a) -25

(b) $-\frac{35}{7}$

(c) $-\frac{8}{35}$

(d) $-\frac{35}{8}$

Sol. (d)

$$1 - 2x = 0 \Rightarrow 2x = 1 \Rightarrow x = \frac{1}{2}$$

$$f\left(\frac{1}{2}\right) = \left(\frac{1}{2}\right)^3 - 6\left(\frac{1}{2}\right)^2 + 2\left(\frac{1}{2}\right) - 4$$

$$= \frac{1}{8} - \frac{3}{2} + 1 - 4$$

$$= \frac{1 - 12 + 8 - 32}{8} = -\frac{35}{8}$$

Q9. The polynomials $ax^3 + 3x^2 - 13$ *and* $2x^3 - 5x + a$ are divisible by x+2 if the remainder in each case is the same, find the value of a.

(a) 5

(b) $\frac{5}{9}$

(c) $\frac{9}{5}$

(d) $\frac{2}{3}$

Sol. (b)

$p(x) = ax^3 + 3x^2 - 13$ and $q(x) = 2x^3 - 5x + a$

when p(x) & q(x) are divided by $x + 2 = 0 \Rightarrow x = -2$

$p(-2) = q(-2)$

$\Rightarrow a(-2)^3 + 3(-2)^2 - 13 = 2(-2)^3 - 5(-2) + a$

$\Rightarrow -8a + 12 - 13 = -16 + 10 + a$

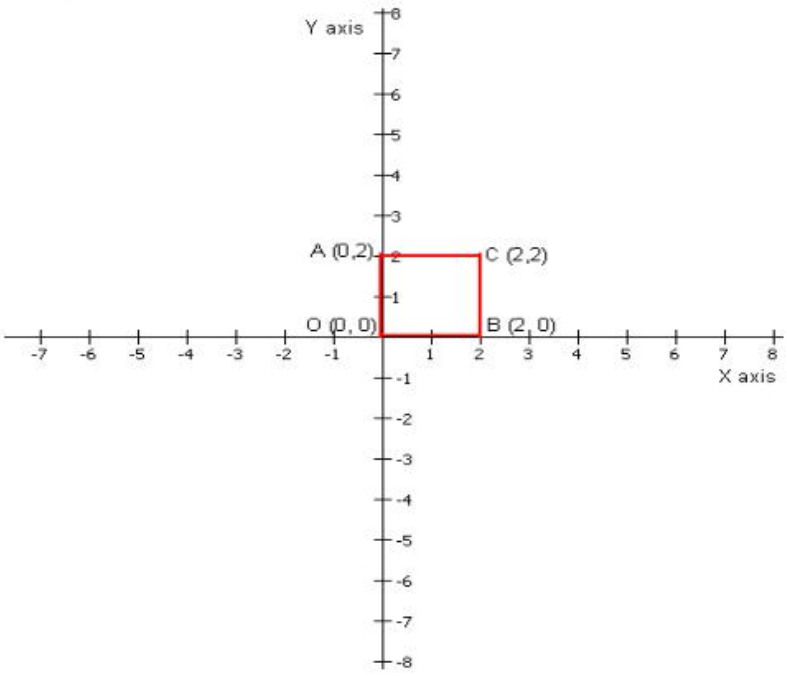
$\Rightarrow -9a = -5$

$\Rightarrow a = \frac{5}{9}$ **Ans.**

Q10. Find the area of a square the coordinates of whose vertices are (0,0), (2,0), (2, 2) and (0,2).

(a) 3
(b) 5
(c) 4
(d) 2

Sol. (c)



Plot the points (0,2) on y-axis and (2,0) on x-axis such that (0,0) is at origin.
AC = BC = OB = OA = 2 units
Area of square = side x side
=2 x 2 = 4 square units

Q11. If an angle differs from its complement by 10, find the angle.

(a) 45°
(b) 40°
(c) 60°
(d) 50°

Sol. (d)

let angles is x^0 then its complement is $90 - x^0$.

Now given $x^0 - (90 - x^0) = 10$

$\Rightarrow x^0 - 90^0 + x^0 = 10$

$\Rightarrow 2x^0 = 10 + 90 = 100$

$\Rightarrow x^0 = \frac{100^0}{2} = 50^0$

$\therefore$ Required angle is 50^0. **Ans.**

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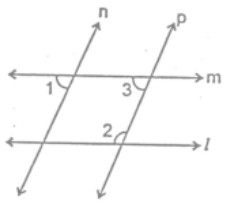
Q12. In figure if l ‖ m, n‖ p and ∠1 = 85° find ∠2.



(a) 85°
(b) 90°
(c) 60°
(d) 95°

Sol. (d)

$\therefore$ n ‖ p and m is transversal

$\therefore$ $\angle 1 = \angle 3 = 85^0$ [Corresponding angles]

Also m ‖ l & p is transversal

$\therefore$ $\angle 2 + \angle 3 = 180^0$ [$\because$ Consecutive interior angles]

$\Rightarrow$ $\angle 2 + 85^0 = 180^0$

$\Rightarrow$ $\angle 2 + 180^0 - 85^0$

$\Rightarrow$ $\angle 2 = 95^0$ **Ans.**

Q13. In fig. 2, AB ‖ CD then find the value of x.

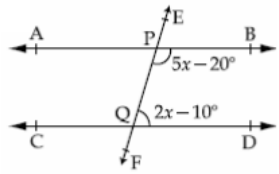


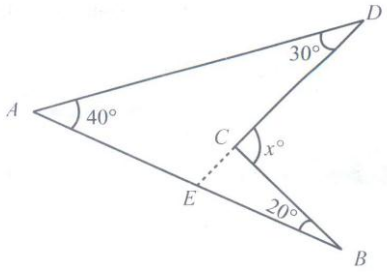
Fig. 2

(a) 30°
(b) 45°
(c) 60°
(d) 90°

Sol. (a)

Since AB || CD and EF is the transversal
∴ ∠BPQ + ∠PQD = 180° [Consecutive interior angles are supplementary]
= 5x – 20 + 2x – 10 = 180°
= 7x – 30 = 180°
= x = 30° ans

Q14. In the given figure find the value of x°



(a) 40°
(b) 50°
(c) 90°
(d) 60°

Sol. (c)

Produced DC such that it meets AB in E
Now in the ΔAED,
Side AE is produced to B
∴ ∠DEB = ∠EDA + ∠DAE [Ext. angle of a triangle]
∠DEB = 30° +40° = 70° = ∠CEB
Now in the ΔBEC,
Side EC is produced to D

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∴ ∠DCB = ∠ CEB + ∠CBE [Ext. angle of a triangle]

Q15. If the three altitudes of a Δ are equal, then triangle is:

(a) Isosceles
(b) Equilateral
(c) Right-angled
(d) None

Sol. (b)

Q16. ABCD is a square and P, Q, R are points on AB, BC and CD respectively such that AP= BQ = CR and ∠PQR = 90°, then ∠QPR

(a) 45°
(b) 50°
(c) 60°
(d) LM

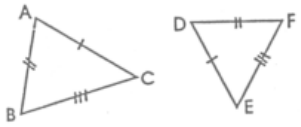
Sol. (a)

Q17. In a ΔPQR, PS is bisector of ∠P and ∠Q = 70° ∠R = 30°, then

(a) QS > PQ > PR
(b) QS < PQ < PR
(c) PQ > QS > SR
(d) PQ < QS < SR

Sol. (b)

Q18. For given figure, which one is correct?



(a) ΔABC ≅ ΔDEF
(b) ΔABC ≅ ΔFED
(c) ΔABC ≅ ΔDEF
(d) ΔABC ≅ ΔEDF

Sol. (b)

Q19. The sides of a triangle park in the ratio 2: 6 : 7 and its perimeter is 300m. Then its area is:

(a) $154\sqrt{57}\ cm^2$
(b) $215\sqrt{45}\ cm^2$
(c) $340\sqrt{56}\ cm^2$
(d) $300\sqrt{55}\ cm^2$

Sol. (d)

s = perimeter/2 =150
Perimeter= 300 = 15x
x = 20
Then, a = 2x20=40
b = 6x20=120
c =7x20=140

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

$= \sqrt{150(150-40)(150-120)(150-140)}$

$= \sqrt{150(110)(30)(10)} = 300\sqrt{55}\ cm^2$

Q20. In the given figure find y, if x = 5°

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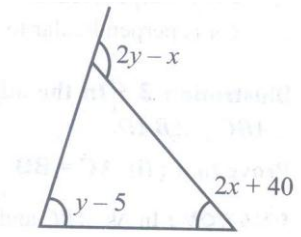

(a) 40°
(b) 50°
(c) 60°
(d) 90°

Sol. (b)
We know that in a triangle exterior angle = sum of two interior opposite angles
2y - x = y – 5 + 2x + 40
2y – y = 2x + 35 + x
Y = 3x + 35
On substituting x = 5°, we get
Y = 3 ×5 + 35 = 15 + 35 = 50°

Q21. If the three vertices of a rectangle taken in order are the points (2, -2), (8, 4) and (5, 7). The co-ordinates of the fourth vertex is
(a) (1,1)
(b) (1, -1)
(c) (-1, 1)
(d) None of these

Sol. (c)
Let fourth vertex be(x,y), then $\frac{x+8}{2} = \frac{2+5}{2}$ and $\frac{y+4}{2} = \frac{-2+7}{2}$ $\Rightarrow x = -1\,, y = 1$

Q22. Find the ratio in which the point $\left(\frac{1}{2}, 6\right)$ divides the line segment joining the points

(3, 5) and (-7, 9)

(a) 2 : 3
(b) 1 : 3
(c) 4 : 3
(d) 1: 2

Sol. (b)

Let $\left(\frac{1}{2}, 6\right)$ divide the line segment joining the points (3, 5) and (-7, 9) in the ratio of k: 1. Using section formula, the x co-ordinater of the diving point is given as

$x = \frac{kx_2+x_1}{k+1}$

$\Rightarrow \frac{1}{2} = \frac{k(-7)+3}{k+1} \Rightarrow \frac{1}{2} = \frac{-7k+3}{k+1} \Rightarrow k+1 = -14k+6 \Rightarrow 15k = 5 \Rightarrow k = \frac{1}{3}$

Q23. Find the value of x such that PQ = QR where co-ordinates of P, Q, R are (6,-1) , (1, 3), and (x, 8) respectively.

(a) 4
(b) -4
(c) 3
(d) -3

Sol. (b)

Since PQ = QR ⇒ is mid-point of PR.

∴ Using mid-points formula,

$1 = \frac{6+x}{2} \Rightarrow 6+x = 2 \Rightarrow x = -4$

Q24. In the figure, find the value of x°.

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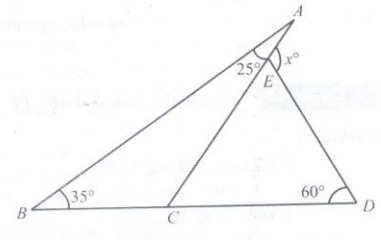


(a) 60°
(b) 120°
(c) 90°
(d) 180°

Sol. (b)

In the ΔABC, ∠A + ∠B + ∠ACB = 180°

$\Rightarrow 25° + 35° + \angle ACB = 180°$

$\Rightarrow \angle ACB = 120°$

Now ∠ACB + ∠ACD = 180° [linear pair]

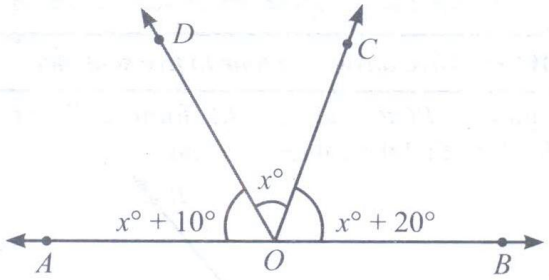
or $120° + \angle ACD = 180°$

or $\angle ACD = 60° = \angle EDC$

Again in the ∠AED = ∠ECD + ∠EDC

$\Rightarrow x = 60° + 60° = 120°$

Q25. In the following figure, find ∠x.

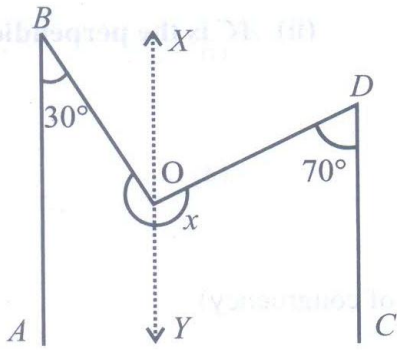


(a) 60°
(b) 50°
(c) 90°
(d) 30°

Sol. (b)

$x° + x° + 10 + x° + 20 = 180° \Rightarrow x = 50°$

Q26. In the given figure, AB ∥ CD and ∠ABO = 30°, ∠ODC = 70° , find x.



(a) 160°
(b) 360°
(c) 260°
(d) 180°

Sol. (c)

Draw a line XY passing through O parallel to AB and CD.

Now $\angle B$ and $\angle BOY$ are interior angles on the same side of transversal OA between parallel lines AB and XY.

$\Rightarrow \quad \angle B + \angle BOY = 180°$

$30° + \angle BOY = 180°$

$\angle BOY = 150°$

Similarly $\angle D$ and $\angle DOY$ are interior angles on the same side of transversal OD between parallel lines XY and CD.

$\Rightarrow \quad \angle D + \angle DOY = 180°$

$70° + \angle DOY = 180°$

$\angle DOY = 180° - 70° = 110°$

Now, $x = \angle BOY + \angle DOY = 150° + 110° = 260°$

Q27. If AB= QR, BC=RP and CA=QP, then which of the following holds?

- (A) $\Delta CBA \cong \Delta PQR$
- (B) $\Delta ABC \cong \Delta PQR$
- (C) $\Delta BCA \cong \Delta PQR$
- (D) $\Delta CAB \cong \Delta \ \Delta PQR$

Sol. (D)

Q28. Solve: $\frac{0.73\times0.73-0.27\times0.27}{0.73-0.27}$

(a) 1
(b) 2
(c) 3
(d) 4

Sol. (a)

$$\frac{0.73\times0.73-0.27\times0.27}{0.73-0.27} = \frac{(0.73)^2-(0.27)^2}{0.73-0.27}$$

$$= \frac{(0.73+0.72)(0.73-0.27)}{(0.73-0.27)} = 0.73 + 0.27 = 1$$

Q29. Find the value of 'a' in the following:

$$\frac{6}{2\sqrt{2}-2\sqrt{3}} = 3\sqrt{2} - a\sqrt{3}$$

(a) -3
(b) -1
(c) -2
(d) -4

Sol. (c)

$$\frac{6}{2\sqrt{2}-2\sqrt{3}} = \frac{6}{2\sqrt{2}-2\sqrt{3}} \times \frac{3\sqrt{2}+2\sqrt{3}}{3\sqrt{2}+2\sqrt{3}}$$

$$= \frac{6(3\sqrt{2}+2\sqrt{3})}{(3\sqrt{2})^2-(2\sqrt{3})^2} = \frac{6(3\sqrt{2}+2\sqrt{3})}{18-12}$$

$$= \frac{6(3\sqrt{2}+2\sqrt{3})}{6} = 3\sqrt{2} + 2\sqrt{3}$$

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Therefore, $3\sqrt{2}+2\sqrt{3} = 3\sqrt{2}-a\sqrt{3}$

$\Rightarrow a = -2$

Q30. Find x^2, if $x = \frac{\sqrt{\sqrt{5+2}+\sqrt{\sqrt{5-2}}}}{\sqrt{\sqrt{5+1}}}$

(a) 1
(b) 2
(c) 3
(d) 4

Sol. (b)

$x^2 = \frac{\sqrt{5}+2+\sqrt{5}-2+2\sqrt{(5)^2-(2)^2}}{\sqrt{5}+1}$

$= \frac{2\sqrt{5}+2}{\sqrt{5}+1} = \frac{2(\sqrt{5}+1)}{\sqrt{5}+1} = 2$