



MONTHLY ASSESSMENT TEST – 2

ANSWER KEY

Q.N	Physics	CC	Chemistry	CC	Mathematics	CC
1.	B	P110409	D	C110305	A	M110820
2.	A	P110420	D	C110309	A	M110813
3.	D	P110413	D	C110302	B	M110715
4.	D	P110420	C	C110302	D	M110827
5.	B	P110413	D	C110702	B	M110731
6.	B	P110507	C	C110704	C	M110734
7.	A	P110502	B	C111006	C	M112603
8.	B	P110501	C	C111006	C	M110718
9.	ACD	P110413	BCD	C110302	ABCD	M112602
10.	AD	P110319	ABC	C110302	ABC	M110726 M110727
11.	ABCD	P110420	ABCD	C110808	ABCD	M110821 M110819
12.	ABC	P110316	BD	C111003	AB	M110802
1.	A – QS B – PQ C – P D – QRS	P110316	A – PQT B – PQRS C – PQST D – PQST	C110305	A – R B – R C – R D – Q	M110723 M110706 M110723 M110722 M110806
2.	A – R B – S C – Q D – P	P110420	A – QRT B – PRT C – PRT D – RST	C110802 C110803	A – QT B – P C – R D – S	M110730 M110731 M110802
1.	5	P110408	5	C110302	0	M110817
2.	3	P110409	9	C110305	5	M110827
3.	1	P110503	4	C110305	2	M110707
4.	4	P110503	5	C111003	8	M110820
5.	6	P110412	3	C110706	8	M111412
6.	0	P110411	2	C110808	2	M111406

Solution

PHYSICS

1. **Ans. B**

Sol.

Magnitude of acceleration of each block is F/m . By using constraint $a_p = 4 F/m$

2. **Ans. A**

3. **Ans. D**

Sol.

$$\text{Force} = V \frac{dm}{dt}$$

4. **Ans. D**

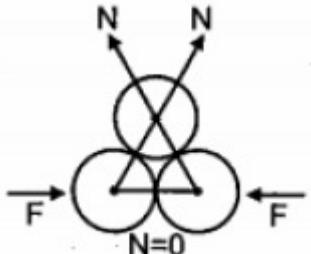
Sol.

For upper cylinder

$$2N \cos 30^\circ = W \quad \dots\dots(1)$$

For lower cylinder

$$N \cos 60^\circ = F \quad \dots\dots(2)$$



$$\text{From (1) and (2)} \frac{2 \cos 30^\circ}{\cos 60^\circ} = \frac{W}{F}$$

$$\Rightarrow F = \frac{W}{2\sqrt{3}}$$

5. **Ans. B**

Sol.

$$k = as^2$$

$$\frac{1}{2}mv^2 = \frac{as^2}{m}$$

$$v = \left(\sqrt{\frac{2a}{m}} \right) s$$

$$\text{Centripetal acceleration} = \frac{v^2}{R} = \frac{2as^2}{mR}$$

$$\text{Tangential acceleration} = v \frac{dv}{ds} = 2as$$

$$\text{Net acceleration} = \frac{2as}{m} \sqrt{1 + \frac{s^2}{R^2}}$$

$$\text{Net force} = 2as \sqrt{1 + \frac{s^2}{R^2}}$$

6. **Ans. B**

7. **Ans. A**

Sol.

$$\Delta KE = \text{work done} = \int_0^{\infty} F_e e^{-kx} dx$$

$$= \left[-\frac{F_0}{k} e^{-kx} \right]_0^{\infty} = \frac{F_0}{k}$$

8. **Ans. B**

Sol.

Force is conservative and displacement zero so work done is zero.

9. **Ans. ACD**

Sol.

$$v_A = v_C = 0$$

$$\text{So, } |a_A| = |a_C| = g \sin \theta = 4g/5$$

According to Conservation of Energy

$$\frac{1}{2}mv_B^2 = mgl(1 - \cos \theta)$$

$$mv_B^2 = 2mgl[1 - (3/5)]$$

$$v_B^2 = 4gl/5$$

$$a_B = \frac{v_B^2}{l} = \frac{4g}{5}$$

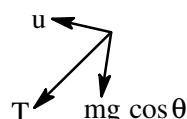
$$\therefore a_A = a_B = a_C$$

$$\text{And } 2a_B = a_A + a_C$$

10. **Ans. AD**

Sol.

(a)



$$T + mg \sin 37^\circ = \frac{mv^2}{r}$$

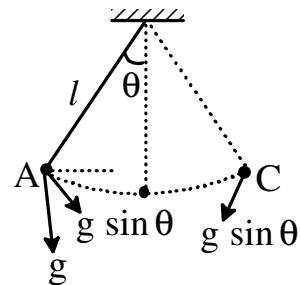
$$\therefore v = \sqrt{\frac{3gr}{5}}$$

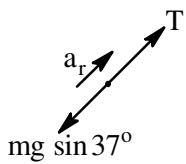
$$(c) mg 2r \sin 37^\circ = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$$

$$\therefore \frac{mv^2}{r} = 3mg$$

$$T - mg \sin 37^\circ = ma_r$$

$$\therefore T = \frac{18mg}{5}$$





11. Ans. ABCD

12. Ans. ABC

Sol.

$$V_E^2 = V^2 + 2g(R - R \cos 60^\circ)$$

$$4gr = V^2 + gR$$

$$\text{or } V = \sqrt{3gR}$$

$$V_B^2 = V_E^2 - 2gR = 2gR$$

$$N = \frac{mV_P^2}{R} = 2mg$$

$$N_E = \frac{mV_E^2}{R} \Rightarrow N_E = 5mg$$

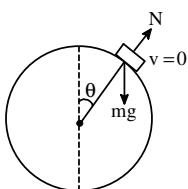
Matrix Match

1. Ans. A – QS, B – PQ, C – P, D – QRS

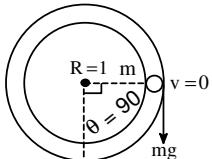
Sol.

$$(a) u = 5 \text{ m/s } v^2 = u^2 - 2gR(1 - \cos \theta)$$

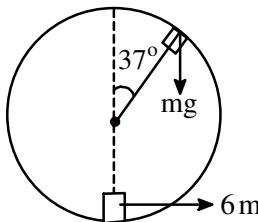
$$\therefore u < u_{\min}, v = 0 \text{ at } \theta = \cos^{-1}\left(\frac{1}{4}\right)$$



$$(b) u = \sqrt{20} \text{ m/s} < u_{\min}$$



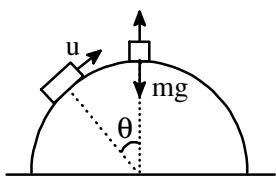
$$(c) u = 6 \text{ m/s} < u_{\min}$$



After leaving the cylinder it will follow projectile path.

$$(d) \frac{1}{2}mu^2 = \frac{1}{2}mv^2 + mgR(1 - \cos \theta)$$

$$v = 0$$



2. Ans. A – R, B – S, C – Q, D – P

Integer Type

1. Ans. 5

Sol.

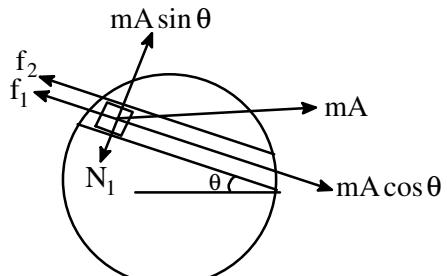
$$mA \cos \theta - \mu mg - \mu mA \sin \theta = ma$$

$$25 \times \frac{4}{5} - \frac{2}{5} \times 10 - \frac{2}{5} \times 25 \times \frac{3}{5} = a$$

$$20 - 4 - 6 = a$$

$$20 - 10 = a \Rightarrow a = 10 \text{ m/s}^2$$

$$\frac{a}{2} = 5$$

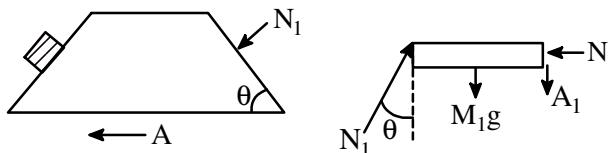


FBD of block with respect to disc

2. Ans. 3

Sol.

Let M_1 be the mass of the rod



$$M_1 g - N_1 \cos \theta = M_1 A_1 \quad (1)$$

$$N_1 \sin \theta = (M + M_1) A \quad (2)$$

$$A = g \tan \theta \quad (3)$$

Relation between A_1 and A

$$A_1 = A \tan \theta$$

Thus, by solving these equations, $M_1 = 3M = 3 \text{ kg}$

3. Ans. 1

4. Ans. 4

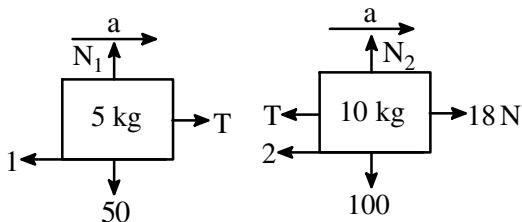
Sol.

Frictional force on 5 kg block = $\mu N_1 = 1 \text{ N}$

Frictional force on 10 kg block = $\mu N_2 = 2 \text{ N}$

Now, $18 - T - 2 = 10 a$ and $T - 1 = 5a$

$$\Rightarrow a = 1 \text{ m/s}^2 \text{ and } T = 6 \text{ N}$$



5. Ans. 6

Sol.

6. Ans. 0

Sol.

Retardation on m when it is moving up (after string breaks)

$$a = \frac{mg \sin 30^\circ + \mu mg \cos 30^\circ}{m} = \frac{g}{2} \left[1 + \sqrt{\frac{3}{2}} \right] = 11 \text{ ms}^{-2}$$

$$\text{So it comes to rest at } t = \frac{v}{a} = \frac{11}{11} = 1 \text{ s}$$

Now since $\mu mg \cos \theta - mg \sin \theta > 0$

$\left(\frac{1}{2} \sqrt{\frac{3}{2}} m \times 10 - m \times 10 \times \frac{1}{2} > 0 \right) m$ will remain at rest afterwards.

$$a = \frac{\mu Mg \cos 30^\circ - Mg \sin 30^\circ}{M} = \frac{g}{2} [1.2 - 1] = 1 \text{ ms}^{-2}$$

It comes to rest at

$$t = \frac{v}{a'} = \frac{11}{1} = 11 \text{ s}$$

For M, also limiting friction $> Mg \sin 30^\circ$

Hence it also remains at rest after $t = 11 \text{ s}$

\therefore Relative velocity at $t = 15 \text{ s} = \vec{v}_1 - \vec{v}_2 = 0$

CHEMISTRY

1. **Ans. D**

Sol.

In $\bullet\text{Ph}_3\text{C}$, carbon is Sp^2 – hybridized

2. **Ans. D**

3. **Ans. D**

Sol.

As symmetry not matches.

4. **Ans. C**

Sol.

B.O of CO^+ is 3.5

5. **Ans. D**

Sol.

Element 'H' is formed covalent hydrides.

6. **Ans. C**

Sol.

Electron affinity of X is equal to ionization energy of X^- with sign reversed.

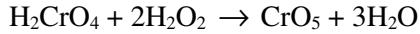
7. **Ans. B**

Sol.

O_3 can not be oxidized by H_2O_2

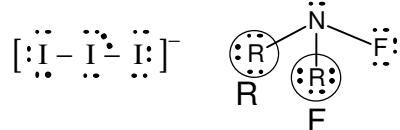
8. **Ans. C**

Sol.



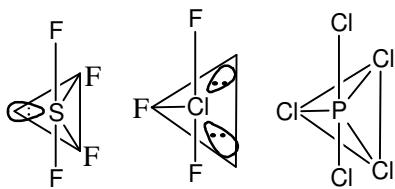
9. **Ans. BCD**

Sol.



10. **Ans. ABC**

Sol.



11. **Ans. ABCD**

Sol.

All are correct.

12. **Ans. BD**

Sol.

Generally transition metals are formed interstitial hydrides.

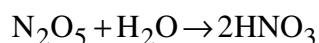
Matrix Match

1. **Ans. A – PQT, B – PQRS, C – PQST, D – PQST**

Sol.



Linear



PCl₅ (Sp³d hybridization)

2. **Ans. A – QRT, B – PRT, C – PRT, D – RST**

Integer Type

1. **Ans. 5**

2. **Ans. 9**

3. **Ans. 4**

4. **Ans. 5**

Sol.

KH, LiH, NaH, CaH₂ and TiH are ionic hydrides.

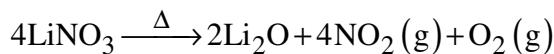
5. **Ans. 3**

Sol.

Electronegativity of Cl is 3.0.

6. **Ans. 2**

Sol.



MATHEMATICS

1. **Ans. A**

Sol. The common chord (radical axis) of the circles should pass through the centre of first circle be. ($x^2 + y^2 + 8x + 8y - b = 0$)

Now, equation of common chord \equiv

$$x^2 + y^2 + 8x + 8y - b - (x^2 + y^2 - 2x + 4y + a) = 0$$

$$\Rightarrow 10x + 4y - a - b = 0$$

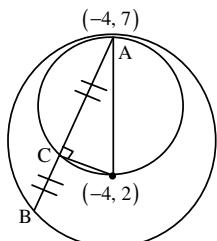
$$\Rightarrow a + b = 10x + 4y \dots\dots\dots (I)$$

As common chord will pass through center of $x^2 + y^2 + 8x + 8y - b = 0$ i.e. from (- 4, - 4),

$$a + b = 10 \times -4 + 4 \times -4 = -56$$

2. **Ans. A**

Sol.



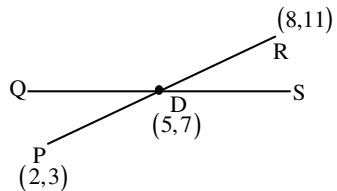
$$\therefore AC = 4 \text{ units}$$

3. **Ans. B**

Sol. As diagonals of a rectangle bisect each other and they are of same length, $PD = DR = QD = DS$

$$PD = \sqrt{(2-5)^2 + (3-7)^2} = \sqrt{9+16} = 5$$

$$\therefore Q \equiv (5, 2) \quad S \equiv (5, 12)$$



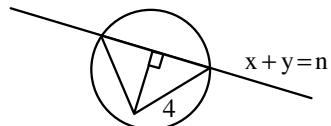
4. **Ans. D**

Sol. Chord will be intersected by $x + y = n$ on circle $x^2 + y^2 = 16$ if and only if length of perpendicular drawn from center of circle i.e. $(0, 0)$ is less than radius.

$$\text{So, } \left| \frac{0+0-n}{\sqrt{1^2+1^2}} \right| \leq 4 \Rightarrow n \leq 4\sqrt{2}$$

So, possible values of $n = 1, 2, 3, 4, 5$

$$\text{Now, length of chord} = 2\sqrt{4^2 - \left(\frac{n}{\sqrt{2}}\right)^2} = 2\sqrt{16 - \frac{n^2}{2}}$$



Sum of squares of length of chords

$$\begin{aligned} & \sum_{n=1}^5 64 - 2n^2 \\ &= 320 - 2 \times \frac{5 \times (5+1) \times (2 \times 5 + 1)}{6} = 320 - 110 = 210 \end{aligned}$$

5. **Ans. B**

Sol. Equation of incident ray $\equiv 3x + 4y - 5 + \lambda(x + y - 1) = 0 \Rightarrow (3+\lambda)x + (4+\lambda)y - (\lambda+5) = 0$

As incident ray and reflected ray form same angle with mirror.

$$\begin{aligned} & \left| \frac{-(3+\lambda) + \frac{3}{4}}{4+\lambda} \right| = \left| \frac{-1 + \frac{3}{4}}{1 + \frac{3}{4}} \right| \\ & \Rightarrow \left| \frac{-12 - 4\lambda + 12 + 3\lambda}{16 + 4\lambda + 9 + 3\lambda} \right| = \left| \frac{-1}{7} \right| \\ & \Rightarrow \left| \frac{-\lambda}{7\lambda + 25} \right| = \left| \frac{-1}{7} \right| \\ & \Rightarrow \lambda = -\frac{25}{14} \end{aligned}$$

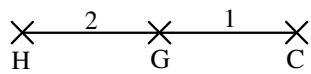
$$\therefore \text{Equation of incident ray} \equiv 17x + 31y = 45$$

6. **Ans. C**

Sol. Circumcenter (c) $\equiv (0, 0)$ (All the vertices are at equal distance from origin)

CM21-MT-2-1921-24

$$\text{Centroid } (G) \equiv \left(\frac{13\sin\theta - 13\cos\theta + 5}{3}, \frac{13\sin\theta - 13\cos\theta + 12}{3} \right)$$



$$\text{Orthocenter } (H) \equiv \left(\frac{2 \times 0 - 3 \times \frac{13\sin\theta - 13\cos\theta + 5}{3}}{2-3}, \frac{2 \times 0 - 3 \times \frac{13\sin\theta - 13\cos\theta + 12}{3}}{2-3} \right)$$

$$\equiv (13\sin\theta - 13\cos\theta + 5, 13\sin\theta - 13\cos\theta + 12)$$

\therefore Equation of line on which orthocenter lies $\equiv x - y + 7 = 0$

7. **Ans. C**

$$\text{Sol. } q \vee (\sim(p \wedge q))$$

$$= q \vee (\sim p \vee \sim q)$$

$$= q \vee \sim q \vee \sim p$$

= Always true

So, it is a tautology

8. **Ans. C**

Sol. As the line $3x + 5y = 14$ passes through 1st, 2nd and 4th quadrants, point which is equidistant from both coordinate axes will lie in only these quadrants.

Now,

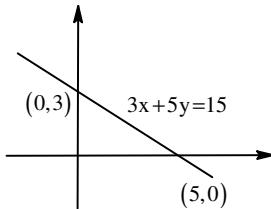
1st quadrant

$$|Y|=|X| \Rightarrow y=x$$

$$\text{So, } 3x + 5x = 15$$

$$\Rightarrow x = \frac{15}{8}$$

$$x=y=\frac{15}{8} \text{ i.e. point } \equiv \left(\frac{15}{8}, \frac{15}{8} \right)$$



2nd quadrant

$$|y|=|x| \Rightarrow y=-x$$

$$3x - 5x = 15$$

$$\Rightarrow x = \frac{-15}{2}$$

$$y = \frac{15}{2}$$

$$\text{Point } \equiv \left(\frac{-15}{2}, \frac{15}{2} \right)$$

$$\underline{4^{\text{th}} \text{ quadrant}} \quad |y|=|x| \Rightarrow -y=x \Rightarrow y=-x$$

$$3x - 5x = 15 \Rightarrow x = -\frac{15}{2}$$

But value of x in 4th quadrant should be positive. So, there will be no such point in 4 th quadrant.

9. **Ans. ABCD**

10. **Ans. ABC**

Sol.

Inclinations of two lines are θ and ϕ . So inclination of angular bisector is $\frac{\theta+\phi}{2} \Rightarrow \alpha = \frac{\theta+\phi}{2}$.

$$(\tan \alpha) \frac{\gamma}{\beta} = -1 \Rightarrow \tan \alpha = -\beta/\gamma. \text{ If } \beta = -\sin \alpha, \gamma = \cos \alpha \Rightarrow \beta^2 + \gamma^2 = 1$$

11. Ans. ABCD

Sol. $S_1 - S_2 = 0 \Rightarrow x - y - 1 = 0$, $S_2 - S_3 = 0 \Rightarrow -6x + 14y - 10 = 0$

$\Rightarrow x = 3, y = 2$, radius of S_4 = length of tangents from (3, 2) to $S_1 = \sqrt{27}$

Equation of S_4 : $(x - 3)^2 + (y - 2)^2 = 27$

$\Rightarrow x^2 + y^2 - 6x - 4y - 14 = 0$

$S_1 - S_4 = 0 \Rightarrow 3x + 2y + 5 = 0$, $S_1 - S_2 = 0 \Rightarrow x - y - 1 = 0$

$\Rightarrow x = -3/5, y = -8/5$

12. Ans. AB

Sol. Equation of circle must be $(x - 2y + 1)(mx + y + 3) + \lambda xy = 0$

Co-eff of x^2 = Co-eff of $y^2 \Rightarrow m = -2$

Co-eff of xy must be zero $\Rightarrow 1 - 2m + \lambda = 0 \Rightarrow \lambda = -5$

Circle : $x^2 + y^2 - \frac{x}{2} + 3y - \frac{3}{2} = 0$ since $2\sqrt{g^2 - c} = \frac{5}{2} \Rightarrow (B)$ is correct

Radius $\sqrt{\frac{1}{16} + \frac{3}{4} + \frac{3}{2}} \neq \sqrt{2} \Rightarrow (C)$ is not correct

(d) is not true since a parabola can always pass through four points if no three of them are collinear.

Matrix Match

1. Ans. A – R, B – R, C – R, D – Q

Sol. (a) Distance between points is more than 5. So 2 lines, one on each side of perpendicular. These lines are $x = 2, y = 3$

(b) Lines $2x^2 + 3xy - 2y^2 + 7x - y + 3 = 0$ are perpendicular to each other. So, orthocentre is their point of intersection i.e. (-1, -1), giving $k = 2$.

(c) Line is $(5n - 5)x - 5ny + (5 + 5n) = 0 \Rightarrow n(x - y + 1) + (1 - x) = 0$, which is a family of lines through (1, 2)

(d) Tangent at (0, 0) is $y = x$. So mirror image is (4, 1)

2. Ans. A – QT, B – P, C – R, D – S

Sol. C_1 has centre $P_1: (4, 4)$ and radius $r_1 = 4\sqrt{2}$. Angular bisector of L_p are $x^2 - y^2 = 0$ i.e. $x = y$ or $x + y = 0$ So, C_2 must lie in 1st quadrant with centre $P_2: (h, h)$ and radius $r_2 = (8-h)\sqrt{2}$

Also $r_2 = OP_2 \sin \theta$ where $\tan 2\theta = \frac{2\sqrt{9^2 - 7^2}}{14} = \frac{4\sqrt{2}}{7}$

Since $\cos 2\theta = 7/9, \sin \theta = 1/3$ giving $(8-h)\sqrt{2} = h\sqrt{2}/3$

$\Rightarrow h = 6$. So $P_2: (6, 6)$, $r_2 = 2\sqrt{2}$, $C_2: x^2 + y^2 - 12x - 12y + 64 = 0$

So, point within R if $L_p < 0$ and $x, y > 0$

Integer Type

1. Ans. 0

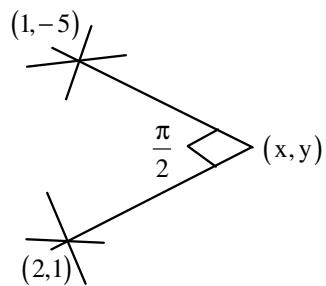
Sol.

$(x - y - 6) + \lambda(2x + y + 3) = 0$ family of line passing through

(1, -5) and

$(x + 2y - 4) + \mu(3x - 2y - 4) = 0$ passing through (2, 1)

Then $\left(\frac{y+5}{x-1}\right)\left(\frac{y-1}{x-2}\right) = -1$



2. Ans. 5

Sol.

Let the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ as centre lies on $2x - 2y + 9 = 0$

$\therefore -2g + 2f + 9 = 0$

cuts $x^2 + y^2 = 4$ orthogonally

$\therefore 2g \times 0 + 2f \times 0 = c - 4$

CM21-MT-2-1921-26

$$\text{Equation of circle } x^2 + y^2 + (2f + 9)x + 2fy + 4 = 0$$

$$(x^2 + y^2 + 9x + 4) + 2f(x + y) = 0$$

passes through point of intersection of $x^2 + y^2 + 9x + 4 = 0$ & $x + y = 0$

$$\therefore \text{points } \left(-\frac{1}{2}, \frac{1}{2}\right) \text{ and } (-4, 4)$$

$$a = -\frac{1}{2}, c = -4, b = \frac{1}{2}, d = 4$$

$$2b+d=2\left(\frac{1}{2}\right)+4=5$$

3. **Ans. 2**

Sol.

$$\text{Equation of AD } y = x + 1$$

$$\text{Equation of BE } y = 2x + 3$$

Midian through C is

$$(\text{slope of BC})(\text{slope of AD}) = -1$$

$$\text{Equation of BC is } y - 4 = -1(x - 3)$$

$$B = \left(\frac{17}{3}, \frac{4}{3}\right)$$

$$\frac{M_{AB} - M_{BE}}{1 + M_{AB} M_{BE}} = \frac{M_{BE} - M_{BC}}{1 + M_{BE} M_{BC}}$$

We will get M_{AB}

4. **Ans. 8**

Sol.

$$PA = PR = 8 - 9$$

$$\text{So } PQ = 8 - a + b$$

$$\text{Also } QD = QR = 8 - b$$

$$\text{So } QP = 8 - b + a$$

$$8 - a + b = 8 - b + a$$

$$\Rightarrow a = b$$

$$PQ = 8$$

5. **Ans. 8**

Sol.

$$A + B = \pi - C$$

$$\begin{aligned} \frac{\sin A \sin B \sin C}{\sin \frac{A}{2} \sin \frac{B}{2} \sin \frac{C}{2}} &= \frac{2 \sin \frac{A}{2} \cos \frac{A}{2} \sin \frac{B}{2} \cos \frac{B}{2} \sin \frac{C}{2} \cos \frac{C}{2}}{\sin \frac{A}{2} \sin \frac{B}{2} \sin \frac{C}{2}} \\ &= 8 \cos \frac{A}{2} \cos \frac{B}{2} \cos \frac{C}{2} \end{aligned}$$

6. **Ans. 2**

Sol.

$$1 + \tan 1^\circ \tan 2^\circ = \frac{\tan 2^\circ - \tan 1^\circ}{\tan 1^\circ}$$

$$1 + \tan 2^\circ \tan 3^\circ = \frac{\tan 3^\circ - \tan 2^\circ}{\tan 1^\circ}$$

$$1 + \tan 88^\circ \tan 89^\circ = \frac{\tan 89^\circ - \tan 1^\circ}{\tan 1^\circ}$$

