1 . Let PQR be a triangle of area Δ with $a=2,\ b=\frac{7}{2}$ and $c=\frac{5}{2}$; where a, b, and c are the lengths of the sides of the triangle opposite to the angles at P, Q and R respectively. Then $\frac{2\sin P-\sin 2P}{2\sin P+\sin 2P}$ equals. *(2012)*

(a) $\frac{3}{4\Delta}$ (b) $\frac{45}{4\Delta}$ (c) $\left(\frac{3}{4\Delta}\right)^2$ (d) $\left(\frac{45}{4\Delta}\right)^2$

Solution: -

1 . **(c)** We have,

$$\frac{2\sin P-\sin 2P}{2\sin P+\sin 2P}=\frac{2\sin P-2\sin P\cos P}{2\sin P+2\sin P\cos P}=\frac{1-\cos P}{1-\sin P}$$

$$=\frac{2\sin^2\frac{P}{2}}{2\cos^2\frac{P}{2}}=\tan^2\frac{P}{2}=\frac{(s-b)(s-c)}{s(s-a)}$$

where $s=\frac{a+b+c}{2}$

$$=\frac{(s-b)^2(s-c)^2}{s(s-a)(s-b)(s-c)}=\frac{(a+c-b)^2(a+b-c)^2}{16.\Delta^2}$$

$$=\frac{1\times 9}{16\Delta^2}=\left(\frac{3}{4\Delta}\right)^2$$