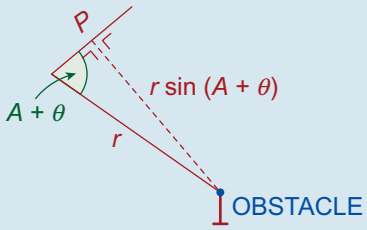
Taking moments about the top of the obstacle:



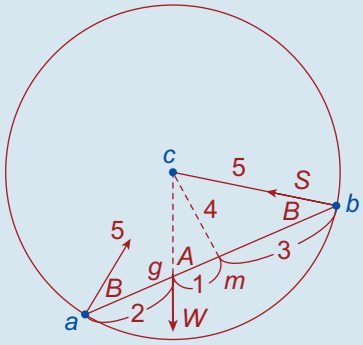
$$W\left(\frac{3}{5}r\right) = P(r\sin(A+\theta))$$
$$\Rightarrow P = \frac{3W}{5\sin(A+\theta)}$$

(i) In this case $\theta = 0$

$$\therefore P = \frac{3W}{5\sin A} = \frac{3W}{4}$$

(ii) In this case we want a minimum value for $\frac{3W}{5\sin(A+\theta)}$. This value is attained when $\sin(A+\theta) = 1$, and is $\frac{3W}{5}$

Q. 8.



Let m be the midpoint $[ab]$.

$|cm| = 4$ (by Pythagoras), $|gm| = 1$ and $|gc| = \sqrt{17}$

$$\sin A = \frac{4}{\sqrt{17}} \text{ and } \sin B = \frac{4}{5}$$

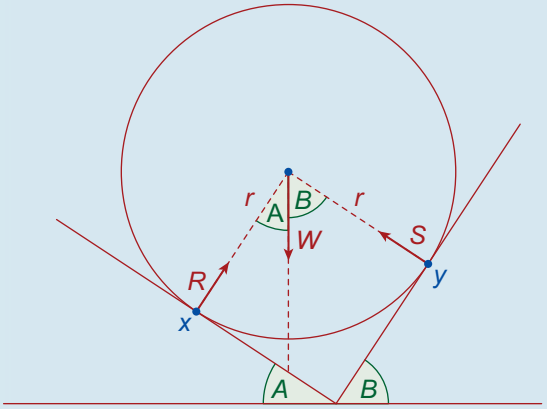
Taking moments about *a*:

$$W(2\sin A) = S(6\sin B)$$
$$\Rightarrow W\left(\frac{8}{\sqrt{17}}\right) = S\left(\frac{24}{5}\right)$$
$$\Rightarrow S = \frac{5W}{3\sqrt{17}}$$

Taking moments about *b*:

$$W(4\sin A) = S(6\sin B)$$
$$\Rightarrow W\left(\frac{16}{\sqrt{17}}\right) = S\left(\frac{24}{5}\right)$$
$$\Rightarrow R = \frac{10W}{3\sqrt{17}}$$

Q. 9.



Since $\tan A = \frac{1}{2}$, $\sin A = \frac{1}{\sqrt{5}}$ and $\cos A = \frac{2}{\sqrt{5}}$

Since $\tan B = \frac{3}{4}$, $\sin B = \frac{3}{5}$ and $\cos B = \frac{4}{5}$

Also, $\sin(A+B) = \sin A\cos B + \cos A\sin B$

$$= \left(\frac{1}{\sqrt{5}}\right)\left(\frac{4}{5}\right) + \left(\frac{2}{\sqrt{5}}\right)\left(\frac{3}{5}\right)$$
$$= \frac{10}{5\sqrt{5}}$$
$$= \frac{2}{\sqrt{5}}$$

Taking moments about *x*:

$$W(r\sin A) = S(r\sin(A+B))$$
$$\Rightarrow W\left(\frac{1}{\sqrt{5}}r\right) = S\left(\frac{2}{\sqrt{5}}r\right)$$
$$\Rightarrow S = \frac{1}{2}W$$

Q.E.D.