Question 9

(50 marks)



Conor's property is bounded by the straight bank of a river, as shown in **Figure 1** above. *T* is the base of a vertical tree that is growing near the opposite bank of the river. |TE| is the height of the tree, as shown in **Figure 2** above.

From the point *C*, which is due west of the tree, the angle of elevation of *E*, the top of the tree, is 60° . From the point *D*, which is 15 m due north of *C*, the angle of elevation of *E* is 30° (see **Figure 2**). The land on both sides of the river is flat and at the same level.

(a) Use triangle *ECT*, to express |TE| in the form $\sqrt{a}|CT|$ metres, where $a \in \mathbb{N}$.

(b) Show that |TE| may also be expressed as $\sqrt{\frac{225+|CT|^2}{3}}$ metres.



(c) Hence find |CT|, the distance from the base of the tree to the bank of the river at Conor's side. Give your answer correct to 1 decimal place.

(d) Find |TE|, the height of the tree. Give your answer correct to 1 decimal place.

(e) The tree falls across the river and hits the bank at Conor's side at the point *F*. Find the maximum size of the angle *FTC*. Give your answer in degrees, correct to 1 decimal place.



(f) If the tree was equally likely to fall in any direction, find the probability that it would hit the bank at Conor's side, when it falls.

Give your answer as a percentage, correct to 1 decimal place.

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