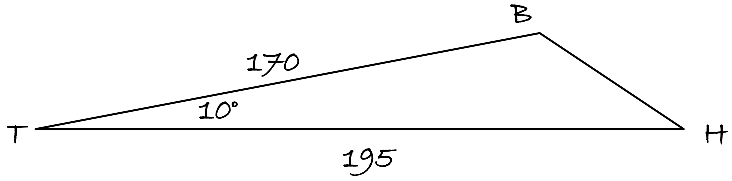
Section 3: The sine and cosine rules

Solutions to Exercise level 2

1.

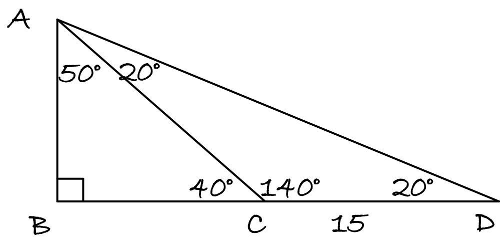


Using the cosine rule: $t^2 = 170^2 + 195^2 - 2 \times 170 \times 195 \cos 10°$

$t = 40.4$

It is 40.4 m from the hole.

2.



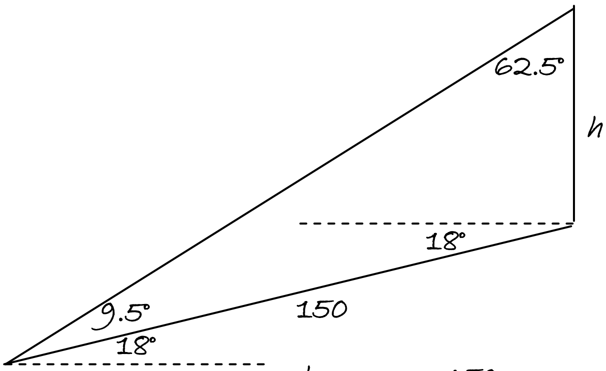
Using the sine rule on triangle ACD: $\dfrac{c}{\sin C} = \dfrac{a}{\sin A}$

$$\frac{c}{\sin 140°} = \frac{15}{\sin 20°}$$

$$c = \frac{15 \sin 140°}{\sin 20°} = 28.2$$

For triangle ABD: $AB = AD \cos 70° = 28.2 \cos 70° = 9.64$ m

3.



Using the sine rule: $\dfrac{h}{\sin 9.5°} = \dfrac{150}{\sin 62.5°}$

$$h = \frac{150 \sin 9.5°}{\sin 62.5°} = 27.9 \text{ m}$$

4.

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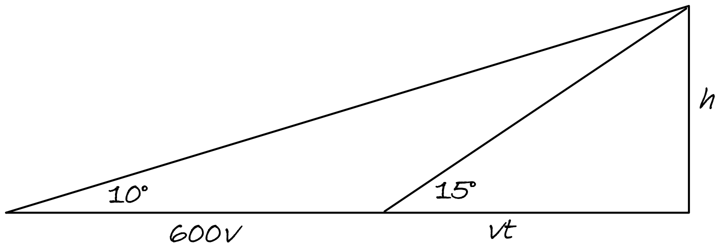

$$\tan 10^\circ = \frac{h}{(600+t)v} \quad \Rightarrow h = v(600+t)\tan 10^\circ$$

$$\tan 15^\circ = \frac{h}{vt} \quad \Rightarrow h = vt\tan 15^\circ$$

$$v(600+t)\tan 10^\circ = vt\tan 15^\circ$$

$$600\tan 10^\circ + t\tan 10^\circ = t\tan 15^\circ$$

$$t = \frac{600\tan 10^\circ}{\tan 15^\circ - \tan 10^\circ} = 1155 \text{ seconds}$$

Time taken = 19 mins 15 seconds

5. (i) $\left.\begin{array}{l} h = (10+x)\tan 15^\circ \\ h = x\tan 40^\circ \end{array}\right\}$

$$\Rightarrow (10+x)\tan 15^\circ = x\tan 40^\circ$$

$$\Rightarrow 10\tan 15^\circ + x\tan 15^\circ = x\tan 40^\circ$$

$$\Rightarrow x = \frac{10\tan 15^\circ}{\tan 40^\circ - \tan 15^\circ} \approx 4.69$$

$$\Rightarrow h = x\tan 40^\circ \approx 3.94$$

5. (ii) $\dfrac{\sin 20^\circ}{6} = \dfrac{\sin\beta}{12} \quad \Rightarrow \sin\beta \approx 0.684$

$$\Rightarrow \beta \approx 43.1^\circ$$

$$\Rightarrow \alpha \approx 180^\circ - 43.1^\circ - 20^\circ = 116.9^\circ$$

$$\theta = 180^\circ - \beta \approx 136.9^\circ, \quad \phi = 180^\circ - 30^\circ - \theta \approx 13.1^\circ$$

$$\Rightarrow x^2 = 6^2 + 12^2 - 2(6)(12)\cos 116.9^\circ \approx 245.15$$

$$\Rightarrow x \approx 15.65$$

$$\frac{c}{\sin\theta} = \frac{x}{\sin\phi} \Rightarrow c \approx 47.2$$