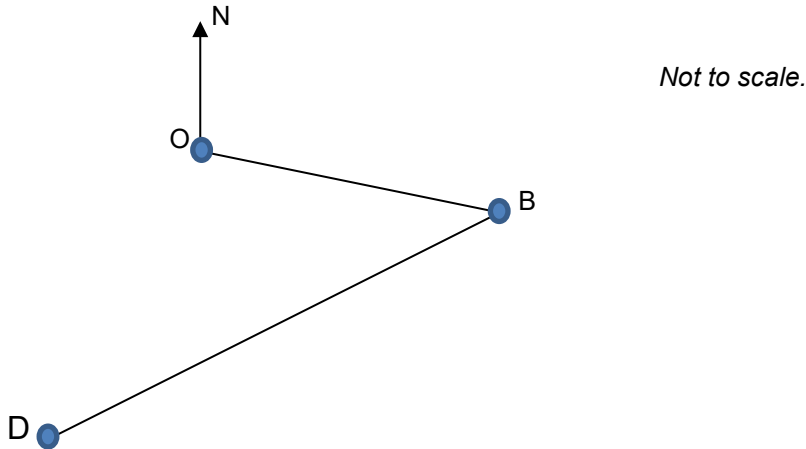


1. Rachael is flying from Ohio (O) to Dallas (D) with a layover in Baltimore (B). This is displayed in the diagram below.



Her flight leaves Ohio on a bearing of 100° and travels 650 km to Baltimore. After changing planes in Baltimore, Rachael's flight leaves for Dallas on a bearing of 235° and travels 2200 km.

- (a) Find \widehat{OBD} . (2 marks)
- (b) (i) If Rachael had found a direct flight from Ohio to Dallas, find the distance of that flight. (2 marks)
- (ii) Find the bearing of that direct flight to Dallas from Ohio. (3 marks)

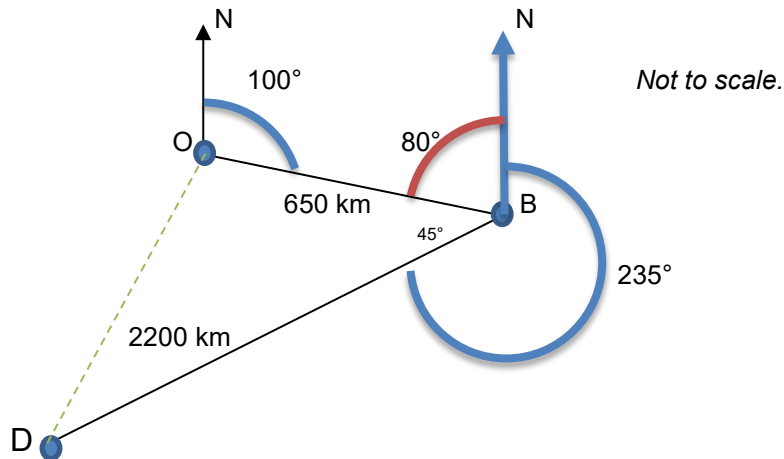
Mark scheme:

(a) Methods vary.

$$180^\circ - 100^\circ = 80^\circ \quad (\text{M1})$$

$$360^\circ - 235^\circ - 80^\circ = 45^\circ \quad (\text{A1})$$

$$O\hat{B}D = 45^\circ$$



(b) (i) Using the Cosine rule

$$OD^2 = 650^2 + 2200^2 - 2 \cdot 650 \cdot 2200 \cos 45^\circ \quad (\text{M1})$$

$$OD = 1800.049 \approx 1800 \text{ km} \quad (\text{A1})$$

(ii) Finding $D\hat{O}B$

$$\text{Sine rule: } \frac{2200}{\sin D\hat{O}B} = \frac{1800}{\sin 45^\circ}$$

$D\hat{O}B \approx 59.8^\circ$, but needing to find a quadrant 2 angle,

$$180^\circ - 59.8^\circ = 120.2^\circ \quad \text{or} \quad (\text{M1})$$

$$\text{Cosine rule: } \cos D\hat{O}B = \frac{650^2 + 1800^2 - 2200^2}{2 \cdot 650 \cdot 1800}$$

$$D\hat{O}B = 120.2^\circ \quad (\text{A1})$$

Adding this angle to the original bearing of 100° ,

$$100^\circ + 120.2^\circ = 220.2^\circ \approx 220^\circ \quad (\text{A1})$$

is the bearing from Ohio to Dallas.