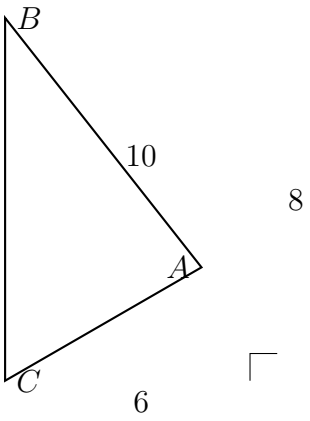
2.5 Navigation applications of the laws of sines and cosines

1. A car is driving up north 24 km. The driver spots a tall building in the distance at a bearing of 30 degrees. The car continues to drive up north and the building now has a bearing of 130 degrees. What is the distance between the driver current location and the building? (Randy) $\triangle ABC$ is shown with $m\angle C = 90°$ and the lengths of the triangle's sides are $BC = 8$, $AC = 6$, and $AB = 10$.



(a) Write down the value of $\sin A$.
[1 mark]

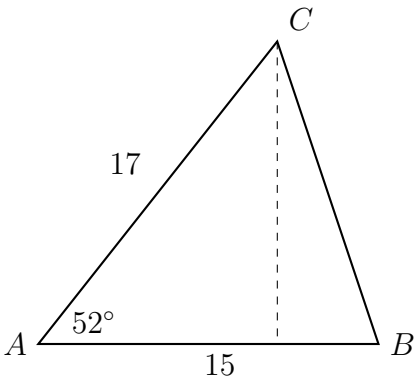
(b) Find the measure of $\angle A$. [2 marks]

2. In right triangle ABC, hypotenuse $\overline{AB}$ has a length of 26 cm, and side $\overline{BC}$ has a length of 17.6 cm. What is the measure of angle B?

Triangle area sine formula

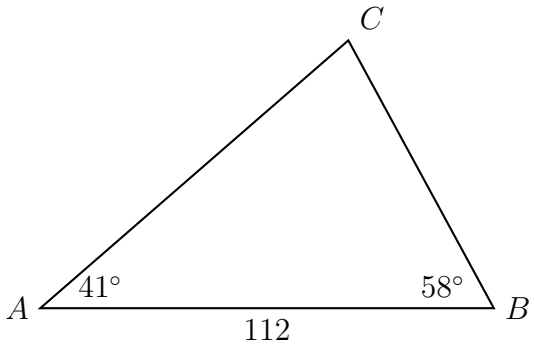
3. Find the area of triangle ABC, with $AB = 15$, $AC = 17$, $m\angle A = 52°$.

   Hint: To use the area formula $A = \frac{1}{2}bh$ first find the altitude using sine and the hypotenuse $AC = 17$.



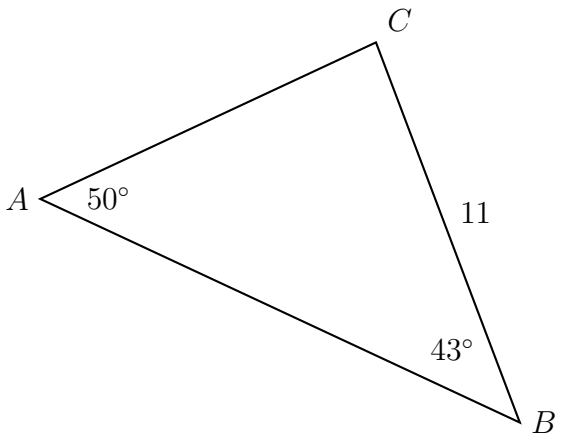
Law of cosines

4. Solve the given triangle (determine the values of all lengths and angles)



Law of sines

5. The following diagram shows triangle ABC (not drawn to scale).

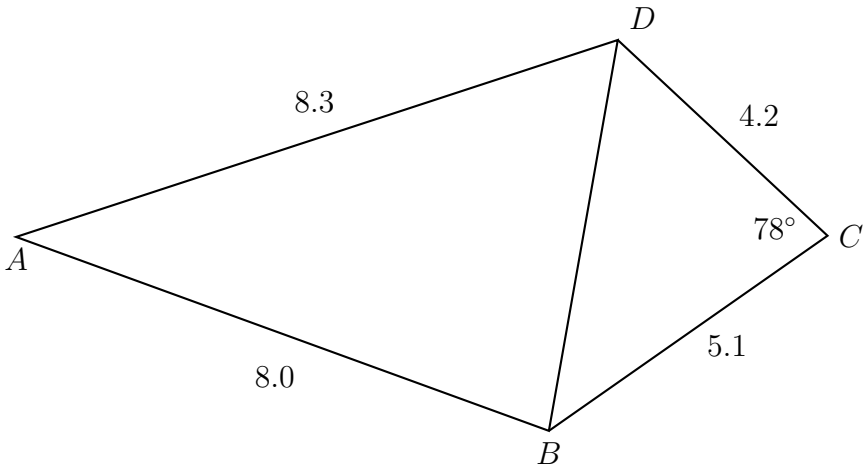


$BC = 11$, $C\hat{A}B = 50°$, and $A\hat{B}C = 43°$

(a) Find AC. [3 marks]

(b) Find the area of triangle ABC. [3 marks]

6. The following diagram shows quadrilateral $ABCD$ (not drawn to scale).



$AB = 8.0$, $BC = 5.1$, $CD = 4.2$, $AD = 8.3$, and $B\hat{C}D = 78°$

(a) Find BD. [3 marks]

(b) Find $A\hat{B}D$. [3 marks]

Precision application

7. BMI is a measure of a healthy personal weight,

$$BMI = \frac{w}{h^2}$$

where
w is a person's weight in kilograms, and
h is height in meters

(a) Given a height of 160 cm and weight of 54 kg, find the BMI [3 marks]

(b) These measurements are not exact. Assuming the height is between 159-161 cm and weight 53-55 kg, find the bounds of the BMI. [4 marks]

Sine ambiguous case

8. Triangle ABC has an area of 25, with $AB = 7$ and $AC = 8$.

   (a) Find the two possible measures for $\hat{A}$. [4 marks]

   (b) Given that $\hat{A}$ is obtuse, find BC. [3 marks]

Solid geometry

9. Find the slant height of a pyramid with square base 4 meters on a side and height of 4 m. [3 marks]

10. Find the volume of a spherical balloon 36 meters in diameter. [3 marks]

11. A cone has a height of 24 cm and volume of $220.5\pi\,\text{cm}^3$. Find its radius. [3 marks]