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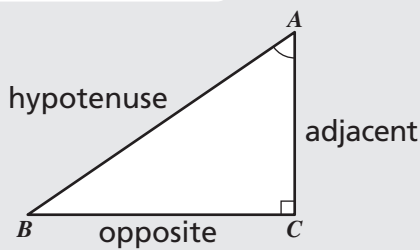
Chapter 2

2.3 Cosine

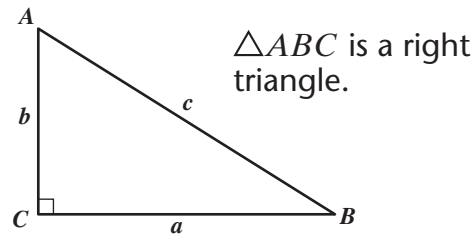
Key Ideas

Cosine is one of the primary trigonometric ratios. It is abbreviated as cos. Cosine is the ratio of the lengths of the adjacent side to the hypotenuse for an acute angle in a right triangle.

$$\cos A = \frac{\text{adjacent}}{\text{hypotenuse}}$$



Examples



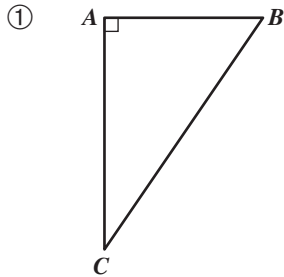
$$\cos A = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{b}{c} \leftarrow \text{adjacent side of } \angle A$$

$$\cos B = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{a}{c} \leftarrow \text{adjacent side of } \angle B$$

Try these!

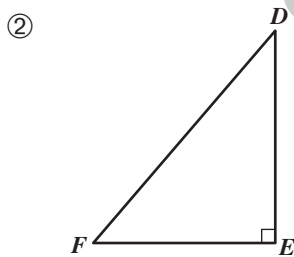


Check the correct cosine ratios and fill in the blanks.



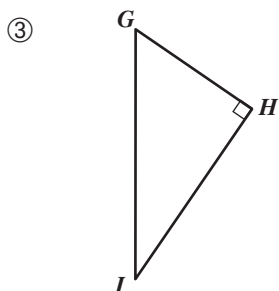
(A) $\cos B = \frac{AB}{BC}$

(B) $\cos B = \frac{AC}{BC}$



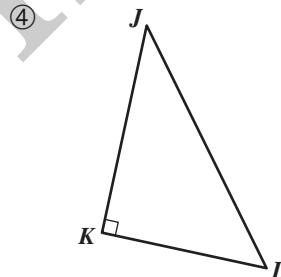
(A) $\cos F = \frac{EF}{DE}$

(B) $\cos F = \frac{EF}{DF}$



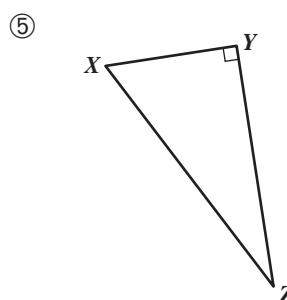
(A) $\cos G = \frac{GH}{GI}$

(B) $\cos G = \frac{HI}{GI}$



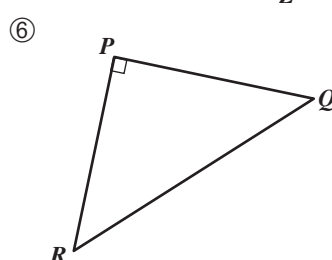
$\cos J = \frac{\square}{JL}$

$\cos L = \frac{\square}{JL}$



$\cos X = \frac{\square}{\square}$

$\cos Z = \frac{\square}{\square}$



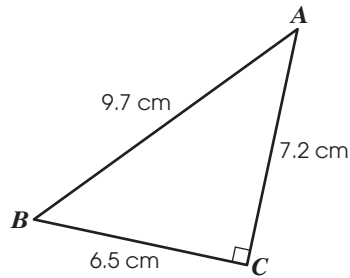
$\cos \square = \frac{PR}{\square}$

$\cos \square = \frac{PQ}{\square}$

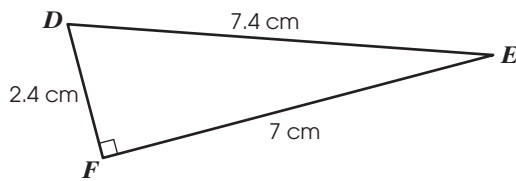


Find the cosine ratios of the specified angles. Round the answers to four decimal places. Show your work.

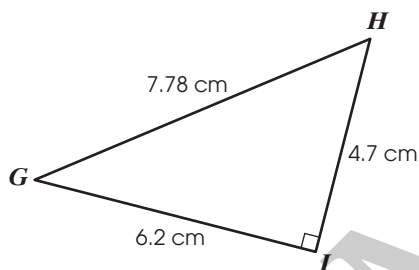
⑦

a. $\angle A$ b. $\angle B$

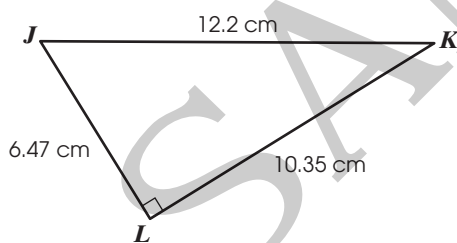
⑧

a. $\angle D$ b. $\angle E$

⑨

a. $\angle G$ b. $\angle H$

⑩

a. $\angle J$ b. $\angle K$

Evaluate each using a calculator. Round your answer to four decimal places if needed.

⑪ a. $\cos 30^\circ =$ _____

b. $\cos 60^\circ =$ _____

c. $\cos 75^\circ =$ _____

d. $\cos 45^\circ =$ _____

e. $\cos 55^\circ =$ _____

f. $\cos 68^\circ =$ _____

g. $\cos 21^\circ =$ _____

h. $\cos 83^\circ =$ _____

Hint



To evaluate cosine ratios using a calculator, look for the "COS" button. Also, make sure the calculator is in degree mode.

Sketch a diagram to illustrate each problem. Then solve it. Show your work.

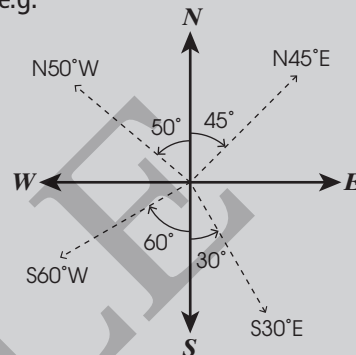
- ⑩ A car drives east for 14 km and then drives another 10 km at $N60^\circ W$. How far is the car from its starting location?

Hint



Directions involving angles are given in reference to either north or south. The angle is then either referred to the east or west.

e.g.



- ⑪ Two boats depart from the same harbour. The *Coast Sign* sails 17 km $S43^\circ W$ and the *Sea Cant* sails 24 km $S28^\circ E$. How far apart are the boats?

- ⑫ A radar spots two objects on the sea's surface. Object A is 48 km away from the radar at $N32^\circ E$ and Object B is 45 km away at $S77^\circ E$. How far apart are the two objects?

- ⑬ Two helicopters and a plane are at the same altitude. Helicopter A is 14 km away from Helicopter B. Helicopter B sees Helicopter A at $N50^\circ W$ and the plane at $N13^\circ E$. Helicopter A sees the plane at $N65^\circ E$. How far is each helicopter from the plane?

Answer the questions.

- ⑩ The front of a house's roof makes an isosceles triangle. The sides are each 7 m long and they make an 80° angle. What is the width of the house?
- ⑪ A cellular tower is tethered to the ground by two wires. The wires make 56° and 76° angles respectively to the ground and are 15 m apart. How long is each wire?
- ⑫ A triangular field has sides of 34 m, 56 m, and 64 m. What is the greatest angle in the triangle?
- ⑬ A new ramp at a skate park contains two sides: the base of the steep side makes a 55° angle with the ground and the long side has a length of 13.4 m. The entire ramp spans 16 m horizontally.
- What is the length of the steep side?
 - What is the measure of the angle that the long side makes with the ground?
- ⑭ A jogger runs 6 km north and then 8 km $S55^\circ W$. What is her distance from her starting position?
- ⑮ A light plane flies 36 km $S60^\circ W$ and a helicopter flies 57 km $S15^\circ E$ from the same airport. How far apart are the two aircraft?
- ⑯ A ship sets sail due north at 36 km/h and a boat sets sail at 17 km/h in the direction of $N80^\circ E$ from the same port. How far apart will they be after 1.5 h?
- ⑰ Chloe looks out of her balcony that is 5 m above the ground. She spots a red car on the ground in the direction of $N50^\circ E$ at an angle of depression of 21° , and a blue car in the direction of $N30^\circ W$ at an angle of depression of 32° . How far apart are the two cars?

MATH IRL

In aviation, pilots use trigonometry extensively to calculate speed and direction. Accounting for wind speed, angles of ascent and descent, and distances will require the use of trigonometry. While modern instruments help perform these calculations, pilots and navigators still need to do quick calculations or, in case of instrument failure, fly entirely by manual calculations. Scan the QR code to learn more about aviation and trigonometry.

**Things I have learned in this chapter:**

- applying the sine law to solve triangles
- applying the cosine law to solve triangles
- determining whether the sine law or cosine law can be used to solve a triangle
- solving word problems using the sine law, cosine law, and the properties of triangles

My Notes:
