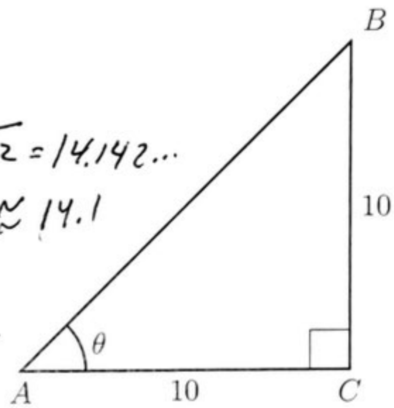
BECA / Dr. Huson / Geometry
Unit 10: Trigonometry
5 May 2023

Name: Solutions

10.10 Special right triangles **HSG.SRT.C.8**

1. Isosceles right $\triangle ABC$ is shown with legs $AC = BC = 10$ as marked.



   (a) Write down θ. 45

   (b) Find the length of hypotenuse AB.

   $AB = \sqrt{10^2+10^2} = \sqrt{200} = 10\sqrt{2} = 14.142\ldots \approx 14.1$

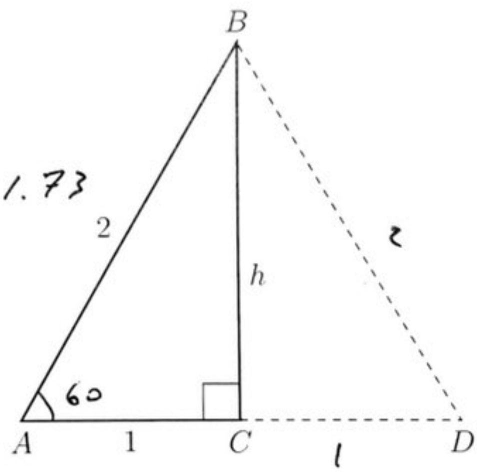
   (c) Write down $\tan A = \frac{10}{10} = 1$

   (d) Find $\cos A = \frac{10}{10\sqrt{2}} = \frac{1}{\sqrt{2}} = 0.70710\ldots \approx 0.707$

   (e) Find $\sin A =$

   $\frac{10}{10\sqrt{2}} = \frac{1}{\sqrt{2}} \approx 0.707$

2. Given right triangle $\triangle ABC$ with base $AC = 1$ and hypotenuse $AB = 2$ as marked.



   (a) Find the altitude $BC = h$.

   $h^2 + 1^2 = 2^2$
   $h^2 = 4 - 1 = 3$
   $h = \sqrt{3} = 1.732\ldots \approx 1.73$

   (b) $\triangle ABC$ is reflected across $\overline{BC}$. Mark the lengths of the sides of its image $\triangle DBC$

   (c) Write down the angle measure of $\angle A$.

   $60°$

   (d) Write down the angle measure of $\angle ABC$.

   30

   (e) Write down $\cos A$.

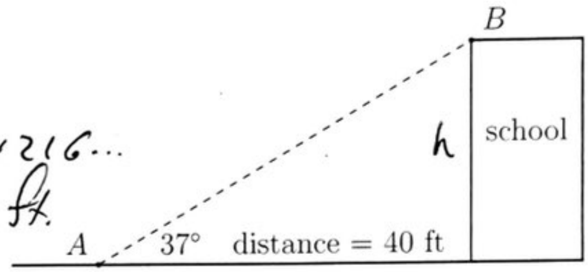
   $\frac{1}{2}$

   (f) Write down $\sin A$.

   $\frac{\sqrt{3}}{2} = 0.8660\ldots \approx 0.866$

3. Shown is a building with student A on the ground waving up to student B. Point A is 40 feet from the base of the building, and the angle of elevation from A to B is $37°$.

   Find how high up student B is from the ground to the *nearest foot.* (not to scale)

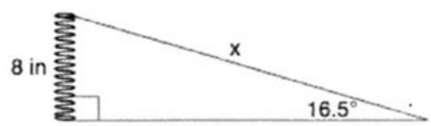


$$\tan 37 = \frac{h}{40}$$

$$h = 40 \tan 37 = 30.14216\ldots$$

$$\approx 30 \text{ ft.}$$

4. Yolanda is making a springboard to use for gymnastics. She has 8-inch-tall springs and wants to form a 16.5 angle with the base, as modeled in the diagram below.



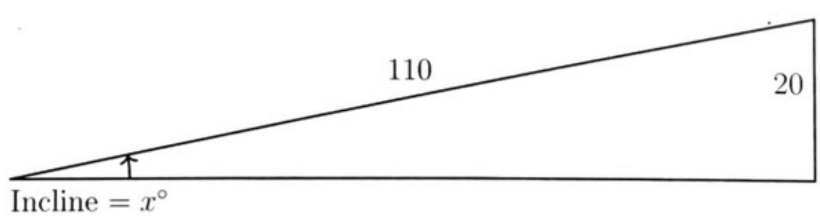
   To the *nearest tenth of an inch*, what will be the length of the springboard, x?

$$\sin 16.5 = \frac{8}{x}$$

$$x = \frac{8}{\sin 16.5} = 28.16749\ldots$$

$$\approx 28.2 \text{ in}$$

5. A child sleds from the top of a hill to a group of friends standing at the base of the hill. The hill is 20 feet tall, and the distance from the sledder to the group of friends is 110 feet. Find the angle of the incline x.



$$\sin x = \frac{20}{110}$$

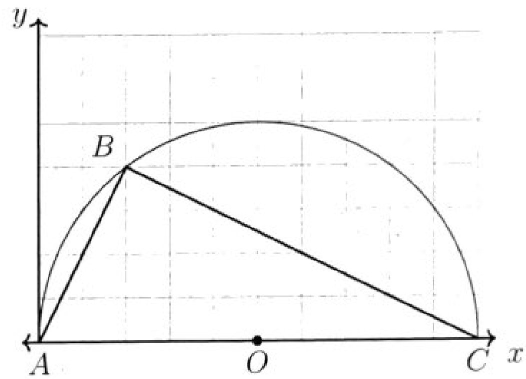
$$x = \sin^{-1}\left(\frac{20}{110}\right) = 10.47568\ldots$$

$$\approx 10°$$

Name: Solutions

Spicy

6. In the diagram below, $\triangle ABC$ is inscribed in circle O. Show that $\overline{AB} \perp \overline{BC}$.



Slopes:

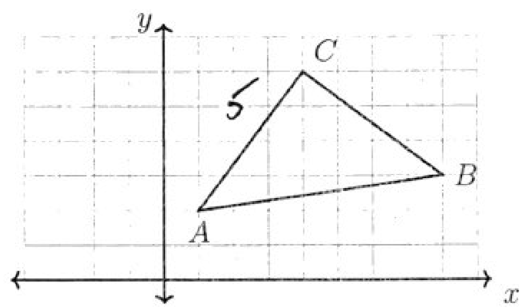
$m_{\overline{AB}} = \frac{4}{2} = 2$

$m_{\overline{BC}} = \frac{-4}{8} = -\frac{1}{2}$

$m_{\overline{AB}} \cdot m_{\overline{BC}} = 2 \cdot \left(\frac{-1}{2}\right) = -1$

$\Rightarrow \overline{AB} \perp \overline{BC}$

7. In the diagram below, $\triangle ABC$ has vertices with coordinates $A(1, 2)$, $B(8, 3)$ and $C(4, 6)$.



Find the length of each side of $\triangle ABC$, showing that it is isosceles and not equilateral.

$AC =$	$BC =$	$AB =$
$\sqrt{(x_C - x_A)^2 + (y_C - y_A)^2}$	$\sqrt{(x_C - x_B)^2 + (y_C - y_B)^2}$	$\sqrt{(x_B - x_A)^2 + (y_B - y_A)^2}$
$= \sqrt{(4-1)^2 + (6-2)^2}$	$= \sqrt{(4-8)^2 + (6-3)^2}$	$= \sqrt{(8-1)^2 + (3-2)^2}$
$= \sqrt{3^2 + 4^2}$	$= \sqrt{(-4)^2 + (3)^2}$	$= \sqrt{7^2 + 1^2}$
$= 5$	$= 5$	$= \sqrt{50}$
		$= 5\sqrt{2}$

$AC = BC = 5 \Rightarrow$ isosceles

$AC \neq AB \Rightarrow$ not equilateral

8. The vertices of quadrilateral $MATH$ have coordinates $M(-4, 2)$, $A(-1, -3)$, $T(9, 3)$, and $H(6, 8)$.

Prove that quadrilateral $MATH$ is a parallelogram.

$$\cancel{m_{\overline{MT}} = \frac{3-2}{9-(-4)} = \frac{1}{13}}$$

$$\cancel{m_{\overline{AH}} = \frac{8-(-3)}{6-(-1)} = \frac{11}{7}}$$

$$m_{\overline{MA}} = \frac{-3-2}{-1-(-4)} = \frac{-5}{3}$$

$$m_{\overline{TH}} = \frac{3-8}{9-6} = \frac{-5}{3}$$

$$m_{\overline{MA}} = m_{\overline{TH}} = \frac{-5}{3}$$

$$\Rightarrow \overline{MA} \parallel \overline{TH}$$

$$m_{\overline{AT}} = \frac{3-(-3)}{9-(-1)} = \frac{6}{10}$$

$$m_{\overline{MH}} = \frac{8-2}{6-(-4)} = \frac{6}{10}$$

$$m_{\overline{AT}} = m_{\overline{MH}} = \frac{6}{10}$$

$$\Rightarrow \overline{AT} \parallel \overline{MH}$$

Opposite sides are parallel

$\Rightarrow$ MATH is a parallelogram