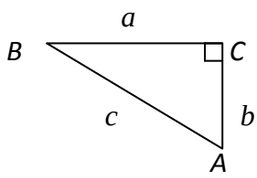
MPM 2DI EXAM REVIEW – Chapters 7 and 8: Trigonometry

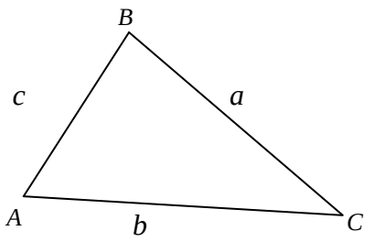
Pythagorean Theorem:
For any right triangle *ABC*,
$c^2 = a^2 + b^2$



Primary Trig Ratios:
For any right triangle, at any angle *A* (not the 90 degree angle):

$$\sin A = \frac{opposite}{hypotenuse} \qquad \cos A = \frac{adjacent}{hypotenuse} \qquad \tan A = \frac{opposite}{adjacent}$$

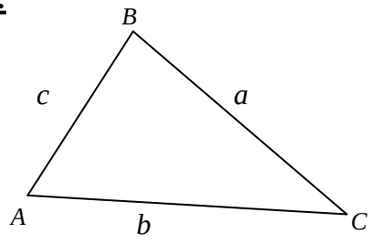
The Sine Law:



For any triangle *ABC*,

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \qquad \textbf{AND} \qquad \frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

The Cosine Law:

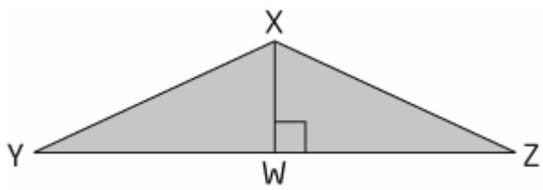


For any triangle *ABC*,
$a^2 = b^2 + c^2 - 2bc \cos A$ **AND** $b^2 = a^2 + c^2 - 2ac \cos B$ **AND** $c^2 = a^2 + b^2 - 2ab \cos C$

Questions

Is your calculator in DEGREE mode?

1. A roof is in the shape of an isosceles triangle with equal sides XY = XZ and equal angles of 24°. The altitude is 3.5m.

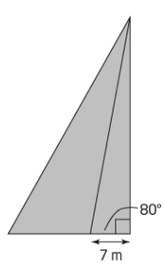


Using the primary trig ratio(s) only, how wide is the roof, rounded to the nearest tenth of a metre?

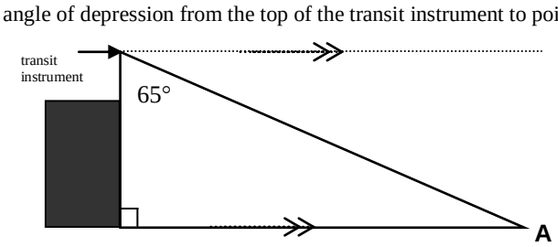
2. A set of steps has a constant slope of $\frac{17}{20}$. What angle do the steps make with the horizontal, to the nearest degree?

3. In $\triangle ABC$, AB = 16 cm, AC = 18 cm, and $\angle B = 90°$. Solve this triangle (angles and lengths to the nearest thousandth).

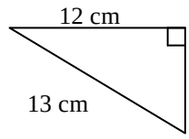
4. A telephone pole (at 90 degrees to the ground) is secured with a cable as shown. The cable makes an angle of 80° with the ground and is secured 7 m from the bottom of the pole. A second cable is attached from the top of the pole and secured to the ground three times as far from the pole as the first cable and on the same side. Find the angle the second cable makes with the ground, rounded to the nearest degree.



5. State the angle of depression from the top of the transit instrument to point A on the ground.



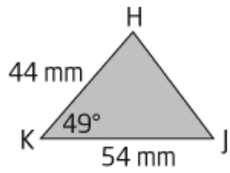
6. **Using the Pythagorean Theorem only**, solve for the missing leg:



7. If $\frac{13.2}{\sin 63^\circ} = \frac{5.9}{\sin W}$, then what is the measure of $\angle W$, to the nearest degree?

8. One of the tallest totem poles in the world is located in Alert Bay, British Columbia. When the angle of elevation of the sun (from the ground) is 62°, the totem pole casts a shadow of 30 m.
   a) Suppose the totem is vertical. How tall is the totem pole, to the nearest tenth of a metre?
   b) Suppose it was not quite vertical, so that it makes an angle of 89° with the ground. In this case, would your answer for its height be taller or shorter than your answer in a)? Justify your calculations.

9. Find the missing side length in $\triangle HJK$, to the nearest tenth of a millimetre.



10. Chang is participating in a charity bicycle road race. The route starts at Centreville and travels east for 13 km to Eastdale. He then makes a 135° angle turn and heads northwest for another 18 km, arriving at Northcote. The final leg of the race returns to Centreville.
    a) What is the total length of the race, rounded to the nearest tenth of a kilometre?
    b) What are the angles in the triangle formed by the three towns, to the nearest degree?

11. Find the perimeter, to the nearest tenth of a centimetre, of a regular polygon with 60 sides that is inscribed in a circle of radius 50 cm. How close is this perimeter to the circumference of the circle? Express your answer as a percent.

Exam Review 7 & 8 Final Answer Section (some full solutions are provided)

1. The roof is approximately 15.8 m wide.

2. The stairs make approximately a 40° angle with the horizontal.

3. *BC* is about 8.246 cm, $\angle A \approx 27.266^\circ$ and $\angle C \approx 62.734^\circ$

4. The second cable makes an angle with the ground measuring approximately 62°.

5. The angle of depression is 25 degrees.

6. Using the Pythagorean Theorem, the missing leg is 5 cm.

7. $\angle W \approx 23^\circ$

8. a) The totem pole is approximately 56.4 m tall.

   b) *If the pole slants away from the sun,*

$$\frac{h}{\sin 62^\circ} = \frac{30}{\sin 29^\circ}$$

$$h \doteq 54.6$$

The height of the pole is approximately 54.6 m.
OR
If the pole slants toward the sun,

$$\frac{h}{\sin 62^\circ} = \frac{30}{\sin 27^\circ}$$

$$h \doteq 58.3$$

The height of the pole is approximately 58.3 m.

9. The third side has a length of approximately 41.6 mm.

10. a) Let N represent the point at Northcote, C at Centreville, and E at Eastdale.

$$NC^2 = 18^2 + 13^2 - 2(18)(13)\cos 45^\circ$$

$$NC \doteq 12.7$$

Total distance $= 12.7 + 13 + 18$

$$= 43.7$$

The race is approximately 43.7 km long.

b) $\frac{\sin \angle N}{13} = \frac{\sin 45^\circ}{12.7}$

$$\angle N \doteq 46^\circ$$

$$\angle C = 180^\circ - 45^\circ - 46^\circ$$

$$= 89^\circ$$

The angles at each town are 45° at Eastdale, approximately 89° at Centreville, and approximately 46° at Northcote.

11. The perimeter of the polygon represents approximately 99.89% of the circumference of the circle.