#1 GA

Reason 3: The Isosceles Triangle Theorem (base angles of an isosceles triangle are congruent)

* In a proof, each step is often a direct result of the one before it. Notice that statement 2 identified two isosceles triangles and that the angles in step 3 are the base angles of those same triangles.

Reason 4: Given

* This statement was part of the originally given information, so you just need to say "given."

Statement 5: $\angle HFM \cong \angle FKM$

* The last step in a proof is always the statement you were asked to prove, so you need only copy it from the original information.

Reason 5: Transitive Property (or Substitution)

* Three angle congruence statements are listed in the proof. When linked together using the transitive property they allow you to say that $\angle HFM \cong \angle FKM$.

$$\underset{\text{(step 3)}}{\angle HFM \cong \angle MHF} \longrightarrow \underset{\text{(step 4)}}{\angle MHF \cong \angle FMK} \longrightarrow \underset{\text{(step 3)}}{\angle FMK \cong \angle FKM}$$

* Since the transitive property is just a special case of the substitution property, you may give either as your reason.

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#2

C If you are <u>not</u> 13 years old, then you are <u>not</u> a teenager.

* To write the inverse, just negate the hypothesis and conclusion.

The inverse is FALSE because 13 is not the only age a teenager can be.
Counterexample: 17 is a teenager

#3 C

* The contrapositive of a true statement (when you negate and switch the order of the hypothesis and conclusion) is always true.

Choice A is not true because you might go sledding at other times as well.
Choice B is not true because it directly contradicts the original statement.
Choice D is not true for the same reason A is not true.

If choice C wasn't true, you would not go sledding when it was snowing, which is impossible due to the original statement. Therefore it must be true.

#4 B

Two triangles could have different side lengths that add up to the same sum.

$$4+8+9 = 5+7+9$$
$$21 = 21$$

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#5

Misleading Diagram

Problem Void

#6 C

(Postulates are assumed to be true, without proof)

#7 D

The sum of the lengths of any two sides of a triangle must be greater than the third side length. Therefore:

$$n < 25 + 20$$

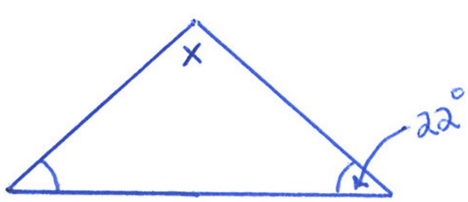
$$n < 45$$

The largest number given as a choice that does not exceed 45 is 44.

#8 $136°$

Since an obtuse triangle can have only one obtuse angle, if it is also isosceles then the obtuse angle is the vertex angle. The $22°$ angle must be one of the two congruent base angles.

Therefore:



$$22 + 22 + x = 180$$

$$44 + x = 180$$

$$x = 136$$

#9 B

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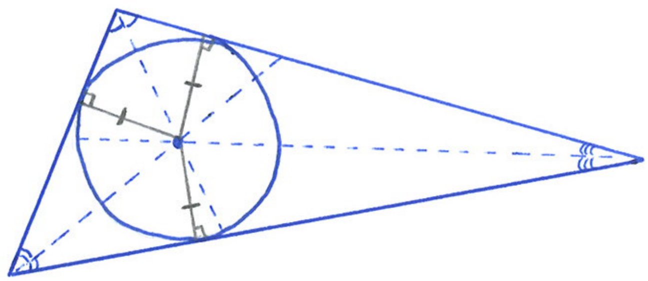
The angle bisectors intersect at the "incenter" of the triangle. Since the incenter is equidistant from the sides of the triangle, a circle whose radius is that distance will fit perfectly inside the triangle.



#10 C

Only choice C names two triangles that contain the given angles in properly corresponding positions.

#11 1) $\overline{NL} \cong \overline{NL}$

Since $\overline{NL}$ is a side shared by $\triangle KLN$ and $\triangle MLN$, stating it is congruent to itself will help prove the triangles congruent.

2) $\triangle KLN \cong \triangle MLN$

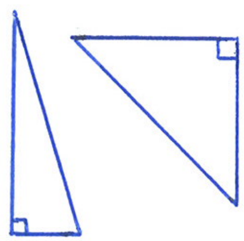
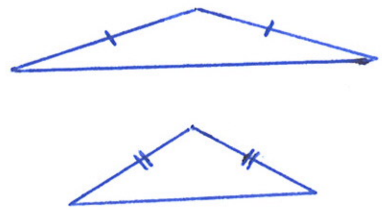
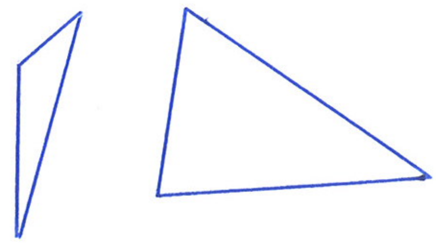
The last statement in a proof is always what was asked to be proven.

3) SAS

Since two sets of corresponding sides and the included angles were stated to be congruent earlier in the proof, you can use the side-angle-side theorem to prove the triangles congruent.

#12 C

Any right isosceles triangle must have two congruent base angles measuring 45° each. Triangles with congruent angles are similar.

Counterexample for A	Counterexample for B	Counterexample for D
		

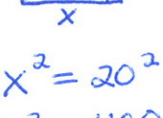
#13 D

The Triangle Proportionality Theorem states:
If a line parallel to a side of a triangle intersects the other two sides, then it divides those sides proportionally.

#14 200 in^2

To calculate the area of the square, you must calculate the side length. Here are two ways to do that:

Pythagorean Theorem



$$x^2 + x^2 = 20^2$$
$$2x^2 = 400$$
$$x^2 = 200$$
$$x = \sqrt{200}$$
$$x = 10\sqrt{2}$$

45°-45°-90° △

Hypotenuse → Leg
$\div \sqrt{2}$

$$\frac{20}{\sqrt{2}} = x$$
$$\frac{20}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{20\sqrt{2}}{2}$$
$$x = 10\sqrt{2}$$

Area □ = side^2

$$= (10\sqrt{2})^2$$
$$= 100 \cdot 2$$
$$= 200 \text{ in}^2$$

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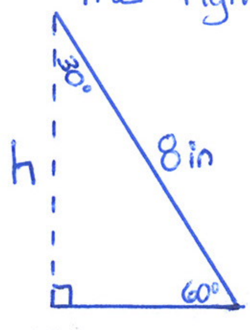
#15 $4\sqrt{3}$ inches C

The right side of the trapezoid forms a 30°-60°-90° triangle.

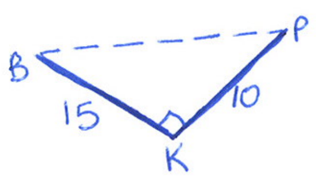


Since the short leg of a 30°-60°-90° triangle is half as long as the hypotenuse, the base of the triangle is 4 inches. The longer side of a 30°-60°-90° triangle is the short leg times $\sqrt{3}$. Therefore:

$$h = 4\sqrt{3}$$

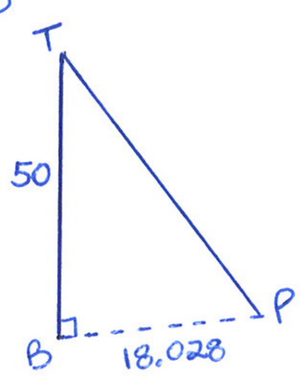
#16 53.15 ft

$\overline{TP}$ is a side of $\triangle TBP$, but since we only know one side length of that $\triangle$, there is not enough info to use it directly. Instead, consider $\triangle BPK$ (draw auxiliary segment $\overline{BP}$ on the base of the sculpture). Use the Pythagorean Theorem to find $\overline{BP}$.



$$15^2 + 10^2 = \overline{BP}^2$$
$$225 + 100 = \overline{BP}^2$$
$$325 = \overline{BP}^2$$
$$\overline{BP} = 18.028$$

Now you can go back to $\triangle TBP$ and use the Pythagorean Theorem again.



$$50^2 + (18.028)^2 = \overline{TP}^2$$
$$2500 + 325 = \overline{TP}^2$$
$$2825 = \overline{TP}^2$$

$$TP = \sqrt{2825} \text{ OR } 5\sqrt{113} \text{ OR } 53.15 \text{ ft.}$$

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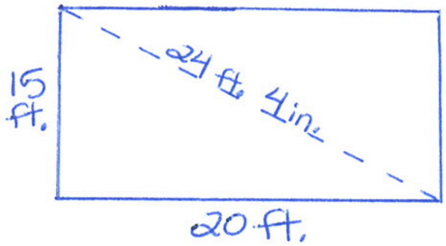
#17 No, not a rectangle



If the wall is a rectangle, it has right angles. If that is true, the side lengths and diagonal will work in the Pythagorean Theorem.

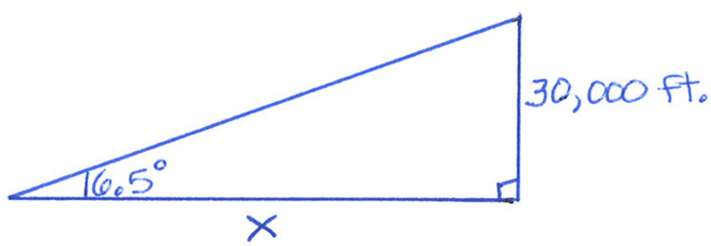
$$15^2 + 20^2 \stackrel{?}{=} 24.\overline{3}^2$$

$$225 + 400 \stackrel{?}{=} 592.\overline{1}$$

$$625 \neq 592.\overline{1}$$

Since the $a^2+b^2=c^2$ relationship doesn't work, the wall is not a rectangle.

#18



Since we know the side opposite the 16.5° angle and need the side adjacent to it, we will use tangent.

$$\tan(16.5°) = \frac{30{,}000}{x}$$

$$\tan(16.5°)\, x = 30{,}000$$

$$x = \frac{30{,}000}{\tan(16.5°)}$$

$$x = 101{,}278 \text{ ft.}$$

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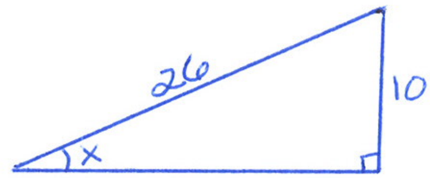
#19 Since $\sin x = \frac{\text{opposite}}{\text{hypotenuse}}$ and $\sin x = \frac{10}{26}$

you can label the triangle accordingly.



From there, you can either use the Pythagorean Theorem to find the third side (24) and then use it in the cosine ratio:

$$\cos x = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{24}{26} \text{ OR } \frac{12}{13} \text{ OR } .923$$

Or, you could use the inverse sine key on your calculator to find x:

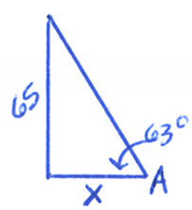
$$\sin^{-1}(10/26) = 22.6199°$$

And then use the cosine button:

$$\cos(22.6199°) = .923$$

#20 56°

Since the given values involve the opposite and adjacent sides of the triangles, we will use tangent.

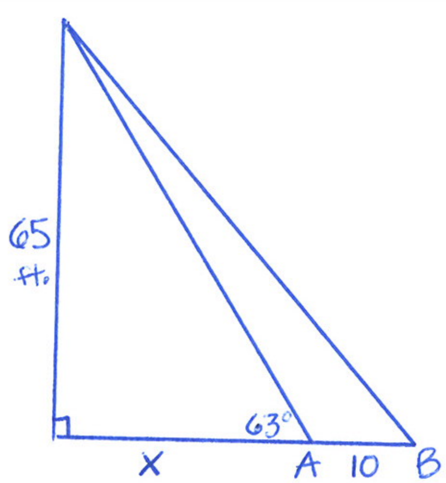


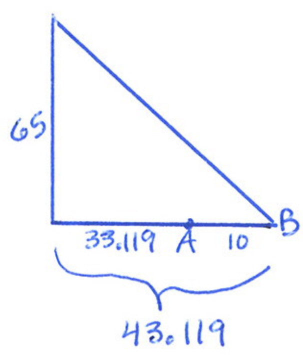
$\tan 63° = 65/x$

$\tan 63° x = 65$

$x = \frac{65}{\tan 63°}$

$x = 33.119$





$\tan \angle B = \frac{65}{43.119}$

$\tan \angle B = 1.50745$

$\tan^{-1}(1.50745) = \angle B$

$\angle B = 56°$