Girls Get Curves

Solution Guide for Chapter 13

Here are the solutions for the "Doing the Math" exercises in *Girls Get Curves*!

DTM from p. 219-220

(Remember, as long as the middle letter stays the same, we can switch the order of the letters in angles whose name uses 3 letters – for example, $\angle ADB$ *is the same exact angle as* $\angle BDA$*. So before you go thinking you have the wrong answer, check to see if your angle name is equivalent to what I've written!)*

2. *Exterior* angles are on the "outside", and *alternate* means they are on opposite sides of the escalator, so those pairs are: $\angle ADB$ & $\angle 4$ and $\angle BDC$ & $\angle 3$.

Answer: $\boldsymbol{\angle ADB}$ **&** $\boldsymbol{\angle 4}$ **and** $\boldsymbol{\angle BDC}$ **&** $\boldsymbol{\angle 5}$

3. *Interior* angles are "inside" the mall, and *same-side* means they're on the same side of the escalator, so those pairs are: $\angle ADE$ & $\angle 1$ and $\angle CDE$ & $\angle 2$.

Answer: $\angle ADE$ & $\angle 1$ and $\angle CDE$ & $\angle 2$

4. *Exterior* angles are on the "outside", and *same-side* means they're on the same side of the escalator, so those pairs are: $\angle BDE$ & $\angle 3$ and $\angle BDC$ & $\angle 4$.

Answer: $\angle BDA$ & $\angle 3$ and $\angle BDC$ & $\angle 4$

5. The vertical pairs are the ones opposite each other, like with chopsticks! And looking just at the *numbered* angles, those pairs are: $\angle 2$ & $\angle 3$ and $\angle 1$ & $\angle 4$.

Answer: $\angle 1$ & $\angle 4$ and $\angle 2$ & $\angle 3$

6. What corresponds to $\angle CDE$? Pretending we're at the mall, let's go down the escalator $\overline{BE}$ and we see that $\angle 4$ is in the same spot as $\angle CDE$, but on a different floor!

Answer: $\angle 4$

7. If $\angle BDA$ = 82°, then what other angles measure 82°? Well, its corresponding angle, $\angle 1$, would also have to measure 82°, and the angle that are vertical to each of these would also have to measure 82°! $\angle CDE$ is vertical to $\angle BDA$, and $\angle 4$ is vertical to $\angle 1$, so they all measure 82°! The question only asked for the *numbered* angles, though, so we'll only list those.

Answer: $\angle 1$ and $\angle 4$

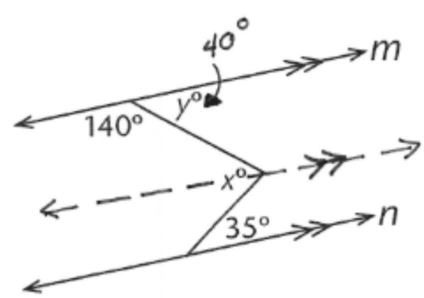
8. If $\angle BDA = 82°$, then since $\angle BDC$ is supplementary to it, that means:

$82° + \angle BDC = 180$

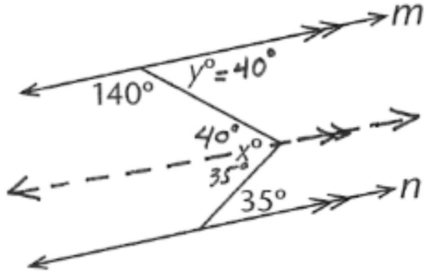
$\rightarrow \angle BDC = 98°$

Answer: 98°

9. Without even looking at the hint, since $y°$ is supplementary to 140°, we automatically know that $y° = 40°$, right? (Since 40° + 140° = 180°). Let's fill that in! And let's also take the hint and draw in a parallel line to *m* and *n*, which passes through the "crook" where $x°$ is.



Great! Now, with what we've learned from this chapter, alternate interior angles will be congruent. Notice that our dotted line has cut the $x°$ into two angles. And now notice that the upper part of the $x°$ angle is the *alternate interior* angle to $y°$! So we can fill in 40° in that spot. Also notice that the part of the $x°$ angle *below* our dotted line is the *alternate interior* angle to 35°, which means that bottom part of $x°$ also equals 35° (since alternate interior angles are always equal in measure)!

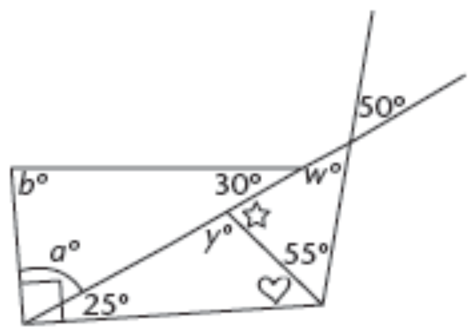


Having filled in both parts of the $x°$ angle, we can now see that $x° = 40° + 35° = 75°$.

Nice!

Answer: $x° = 75°$

DTM from p. 224-225



2. Okay, we're supposed to find the star, right? Well, it's one of the angles in the little triangle on the right, whose other angles are $w°$ and 55°. Hmm. If only we knew $w°$ … Wait! Since $w°$ is vertical to the angle up top that measures 50°, that means $w° = 50°$, too! The angles in every triangle always add up to 180°, so that means:

$$50° + 55° + \text{star} = 180°$$

$$\rightarrow 105° + \text{star} = 180°$$

$$\rightarrow \text{star} = 75°$$

Answer: 75°

3. Now we want to find the heart! It's part of a triangle whose other angles are 25° and y°. But since y° is supplementary to the star, and we learned in #2 that the star = 75°, that means y° = 105°, right? The angles in every triangle always add up to 180°, so that means:

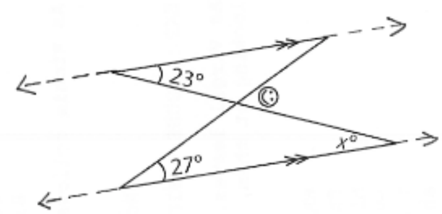
$$25° + 105° + \text{heart} = 180°$$

$$\rightarrow 130° + \text{heart} = 180°$$

$$\rightarrow \text{heart} = 50°$$

Answer: 50°

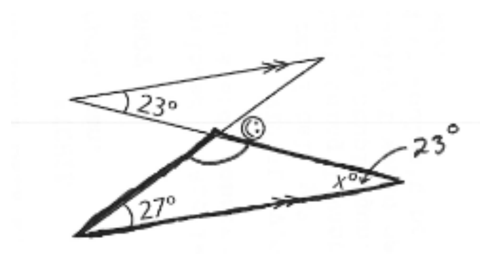
4. Hm, x° sure looks like it would be part of a "oh-no-he-didn't Z-snap" – in other words, part of a big Z that shows us where alternate interior angles are… but where exactly is the escalator and where are the floors? Let's take the hint and extend the parallel lines (which should be the floors of the mall, after all, because they're parallel!). And let's tilt the diagram, too, just to make the floors look more like floors!



Ah, much better. Now it's clear that x° is an alternate interior angle to the one marked 23°, which also means that x° = 23°. Nice. The problem also wants us to state the Rule that makes it true, so we'll do that, too! (Hint: It's the Rule we just used…)

Answer: x° = 23°; if || lines, then alt. int. ∠'s are ≅ .

5. Now we want to find the smiley face, eh? The hint says to remember supplementary angles. What's supplementary to the smiley face? The obtuse angles that are each part of the two triangles we see on the original diagram! Let's focus on the triangle that has angles $x°$ and 27°. Since we know that $x° = 23°$, we can find that obtuse angle, because the angles in *every* triangle *always* add up to 180°!



$$23° + 27° + \text{obtuse angle} = 180°$$

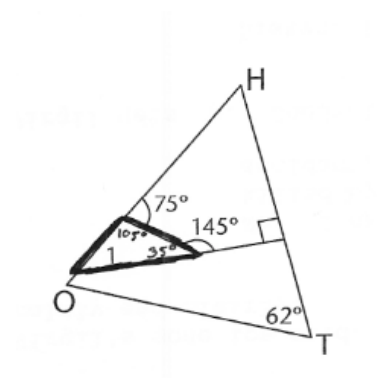
$$\rightarrow 50° + \text{obtuse angle} = 180°$$

$$\rightarrow \text{obtuse angle} = 130°$$

And now that we have the obtuse angle, since it's supplementary to the smiley face, that means the smiley face must equal 50° (since 130° + 50° = 180°, after all!).

Answer: 50°

6. In the HOT diagram, let's just start filling in stuff we know. Well, we can find each of the angles that are supplementary to the angles marked with little arcs and fill them in, right? So, 75° would be supplementary to **105°**, and 145° would be supplementary to **35°**, right? Filling those in, we see that $\angle 1$ is an angle that is part of a triangle whose other angles are 105° and 35°, and now we can solve for $\angle 1$ (because the angles in every triangle always add up to 180°, of course!).



$105° + 35° + \angle 1 = 180°$

$\rightarrow 140° + \angle 1 = 180°$

→ $\angle 1 = 40°$

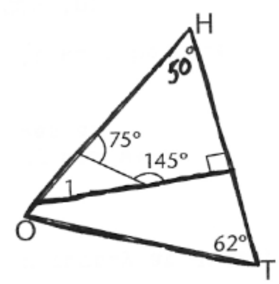
Answer: 40°

7. We're supposed to find $\angle HOT$. Hm. The hint says to find $\angle H$ first, so let's do that! Well, is $\angle H$ part of a triangle? Yep! It's part of the big HOT triangle, and it's also part of the right triangle whose other angle is $\angle 1$. And since we already found out $\angle 1$ = **40°** from #6, and because all right angles measure 90°, we can find $\angle H$:

$$\angle H + 40° + 90° = 180°$$

$$\rightarrow \angle H + 130° = 180°$$

$$\rightarrow \angle H = \mathbf{50°}$$



Okay, now what did the problem want? It wanted us to find $\angle HOT$, the angle in the big HOT triangle. And now that's easy, because we know $\angle H = 50°$, and the other angle in the big triangle is marked as 62°, so we can do:

$$50° + 62° + \angle HOT = 180°$$

$$\rightarrow 112° + \angle HOT = 180°$$

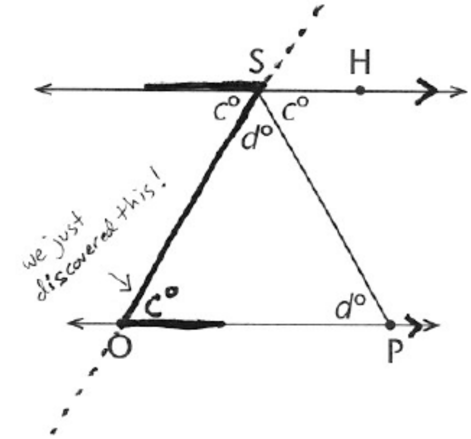
$$\rightarrow \angle HOT = 68°$$

Ta-da!

Answer: 68°

8. We are given that $\overleftrightarrow{SH} \parallel \overleftrightarrow{OP}$, and there are segments intersecting both of them (escalators at the mall!). Let's use the hint, extending out $\overline{OS}$ and covering up $\overline{SP}$ to see

the isolated mall and escalator – and the big "Z" – and now we can see that $\angle SOP$ must be congruent to the $c°$ on the upper left.



Since $\angle SOP$ measures $c°$, it's very easy to write $\angle SOP$ "in terms of" $c°$. We just write $\boldsymbol{\angle SOP = c°}$.

Done!

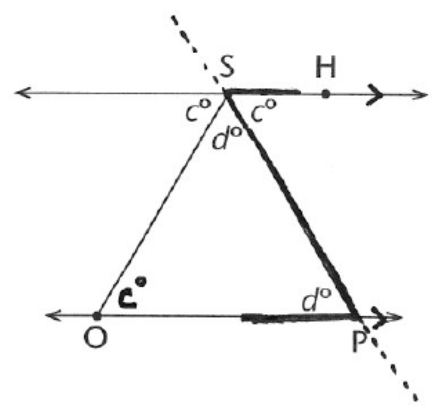
For part b, we just look at that top part of the diagram and notice that $c°$, $d°$, and $c°$ are all making up a straight line, aren't they? Which means they must all add up to 180°.

Finishing that sentence is easy: $c° + d° + c°$ **= 180°**

Part c: Since $\angle SOP$, $d°$, and $d°$ are the three angles in a triangle, we know they add up to 180°! So finishing this sentence is easy, too:

$\angle SOP + d° + d°$ **= 180°**

Part d: Okay, we're supposed to find $c°$, right? We can do this a few ways! One way is to notice that on the right, we have a big backwards "Z", revealing alternate interior angles - $\angle HSP$ (which equals $\boldsymbol{c°}$) and $\angle SPO$ (which measures $\boldsymbol{d°}$) - and since they are alt. int. angles, that means they have the SAME measure, which means it must be true that



$\boldsymbol{c° = d°}$. Make sure you followed that! And since $\boldsymbol{c° = d°}$, we can take part b's equation, $\boldsymbol{c° + d° + c° = 180°}$, and REPLACE d with c, right? And then we get:

$$c° + d° + c° = 180°$$

$$\rightarrow c° + c° + c° = 180°$$

$\rightarrow 3c° = 180°$

$\rightarrow$ $\boldsymbol{c° = 60°}$

Great!

Now, how do we figure out if $\triangle OSP$ is equilateral? Well, if **$c°$ = 60°**, then since **$c°$ = $d°$**, that means **$d°$ = 60°**, too. And that means all three angles in our triangle equal 60, which means $\triangle OSP$ is indeed equilateral.

Again, there is more than one way to get this answer, so don't worry if your method was different… Nice job following that!

Answer:

a. $\boldsymbol{\angle SOP} = \boldsymbol{c}°$

b. **180°**

c. **180°**

d. **$c°$ = 60°, yes it's equilateral**