SECTION SUMMARY AND STUDY ITEMS

Section 10.1 Lines and Angles

Angles can represent an amount of rotation or a region formed between two rays that meet. There are three important relationships concerning angles produced by configurations of lines. When two lines meet, the angles opposite each other are equal. When two parallel lines are cut by a third line, the corresponding angles that are produced are equal; this is called the Parallel Postulate. Three lines can meet so as to form a triangle. The angles in a triangle add to 180°.

Key Skills and Understandings

1. Be able to discuss the concept of angle.
2. Use the fact that a straight line forms a 180° angle to explain why the angles opposite each other, which are formed when two lines meet, are equal.
3. Know how to show informally that the sum of the angles in a triangle is 180°.
4. Use the Parallel Postulate to prove that the sum of the angles in every triangle is 180°.
5. Use the idea of walking around a triangle to explain why the sum of the angles in every triangle is 180°.
6. Apply facts about angles produced by configurations of lines to find angles.

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one full revolution is 360°

Practice Exercises for Section 10.1

3 full revolutions

1. My son once told me that some skateboarders can do "ten-eighties." I said he must mean 180s, not 1080s. My son was right, some skateboarders can do 1080s! What is a 1080, and why is it called that? By contrast, what would a 180 be?

half a turn (half of 360)

1080 ÷ 360 = 3 or 1080 ÷ 3 = 360

2. Use a protractor to measure the angles formed by the shape in Figure 10.19.

360 is 1 full turn
360 + 360 = 720 is 2 turns
360 + 360 + 360 = 1080 is 3 turns.

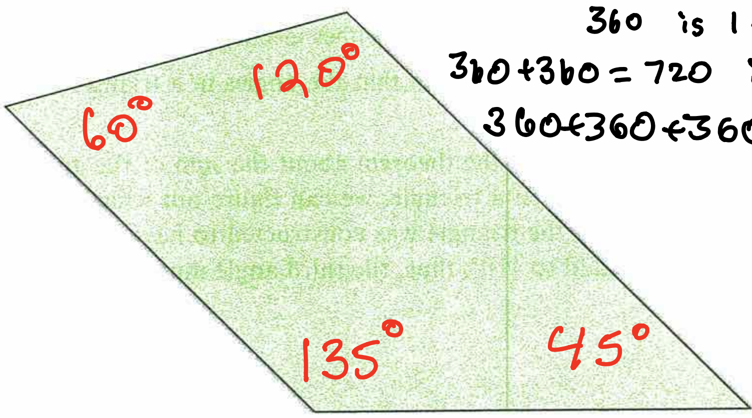

Figure 10.19 Measure the angles.

3. Suppose that two lines in a plane meet at a point, as in Figure 10.20. Use the fact that the angle formed by a straight line is 180° to explain why $a = c$ and $b = d$. In other words, prove that opposite angles are equal.

4. Given that the indicated lines in Figure 10.21 are parallel, determine the unknown angles without actually measuring them. Explain your reasoning briefly.

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4. Given that the indicated lines in Figure 10.21 are parallel, determine the unknown angles without actually measuring them. Explain your reasoning briefly.

the inside (interior) angles of a triangle add to 180°

70+68=138

180−138=42

explanation 2

l=42° because we have the triangle c=70° l m=68°

OR

explanation 1

(from the line cutting through a pair of parallel lines)

180−42=138

because 180−70=110

because we have parallel lines

the > > tell you the two lines are parallel to each other

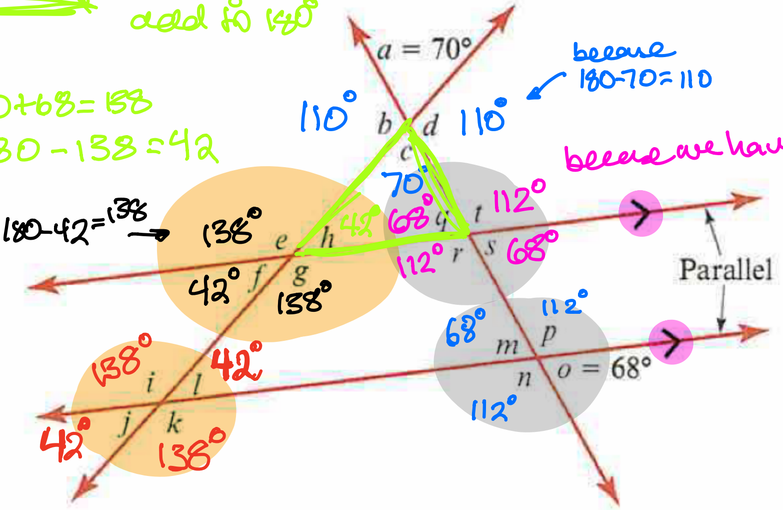

Figure 10.21 Find all angles.

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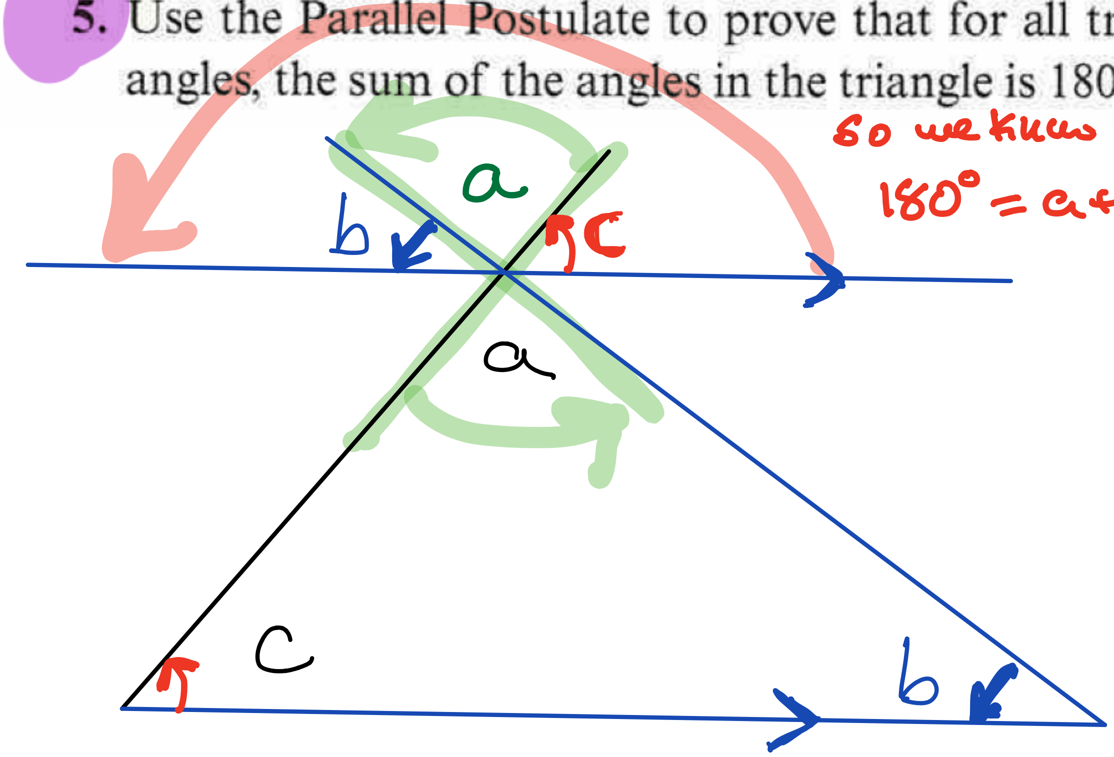
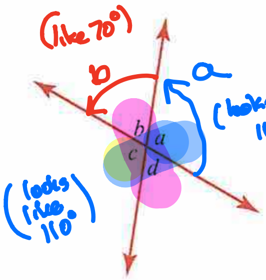
5. Use the Parallel Postulate to prove that for all triangles, the sum of the angles in the triangle is 180°.



So we know that $180° = a+b+c$. ■

a + b = 180° because a+b add up to make a straight line



a+b=180°
c+d=180°
a+d=180°
b+c=180°

Let's use some of these facts to try to get to a=c.

a=180−b
c=180°−b
So that means, $\boxed{a=c}$. ■ (we proved it!)

Figure 10.20 Lines meeting at a point.

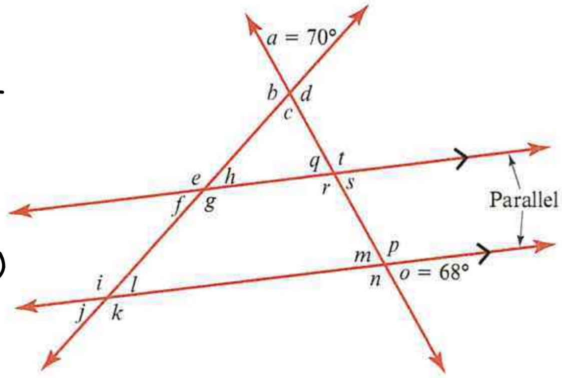


Figure 10.21 Find all angles.

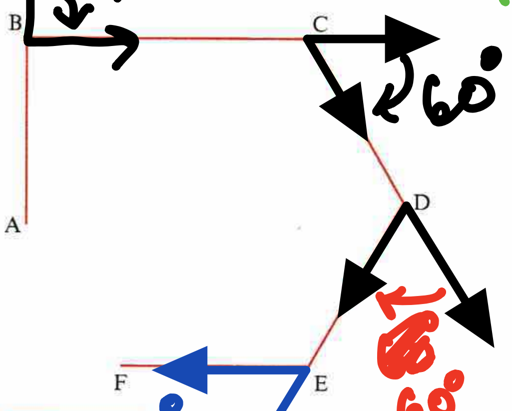
5. Use the Parallel Postulate to prove that for all triangles, the sum of the angles in the triangle is 180°.

6. Dorothy walks from point A to point F along the route indicated on the map in Figure 10.22.

   a. Show Dorothy's angles of turning along her route. Use a protractor to measure these angles.

   b. Use your answers to part (a) to determine Dorothy's total amount of turning along her route. 270°

   c. Now determine Dorothy's total amount of turning along her route in a different way than in part (b). (without a protractor)



She goes 3/4 of a full rotation, 3/4 of 360° is 270°

Figure 10.22 Dorothy's route.

7. Use the "walking and turning" method of Class Activity 10F to explain why the angles in a triangle add to 180°.

8. Figure 10.23 shows a square inscribed in a triangle. Since the square is *inside* the triangle, does that mean that the angles in the square add up to fewer degrees than the angles in the triangle?

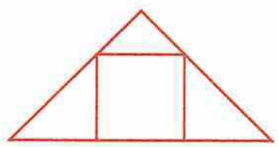


Figure 10.23 A square in a triangle.

90 + 60 + 60 + 60 = $\boxed{270°}$

Answers to Practice Exercises for Section 10.1

1. A "ten-eighty" is 3 full rotations. This makes sense because a full rotation is 360°, and

$$3 \times 360° = 1080°$$

A "180" would be half of a full rotation, which is not very impressive by comparison (although *I* certainly couldn't do it on a skateboard).

2. See Figure 10.24.

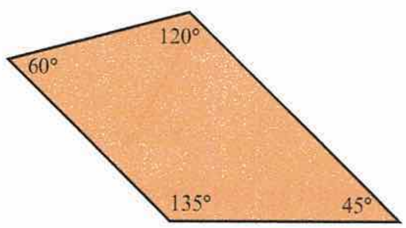


Figure 10.24 Angles in a shape.

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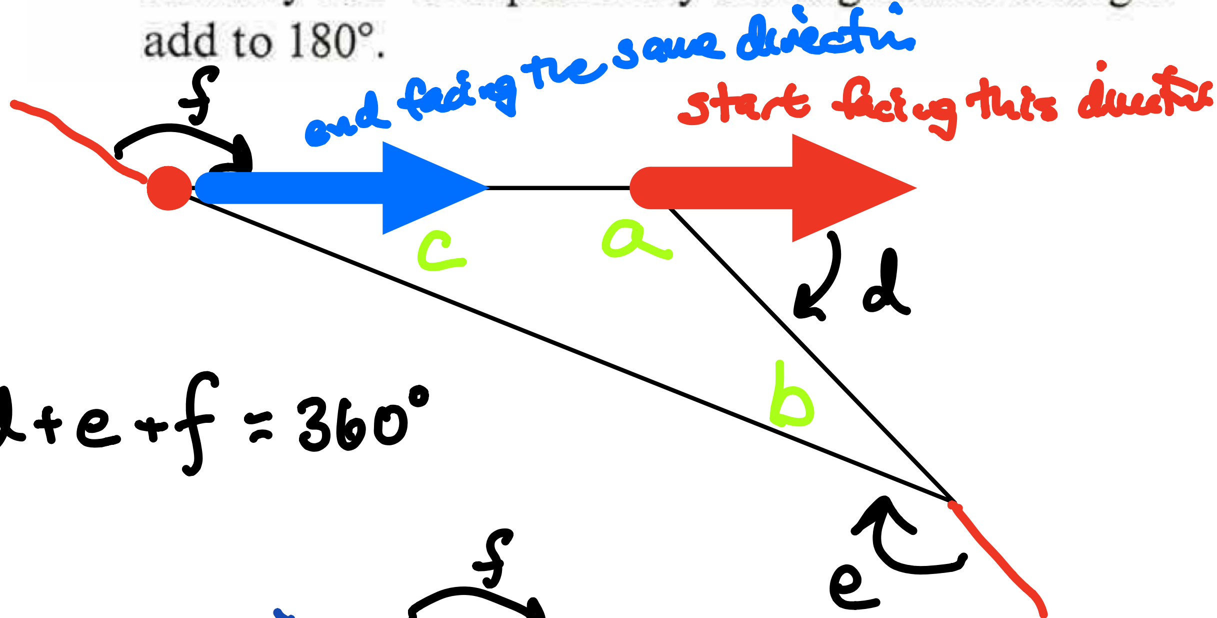
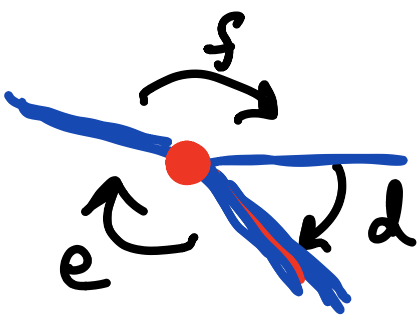
7. Use the "walking and turning" method of Class Activity 10F to explain why the angles in a triangle add to 180°.



$d+e+f=360°$



$d = 180° - a$

$e = 180° - b$

$f = 180° - c$

$d+e+f = 360°$

$(180°-a)+(180°-b)+(180°-c) = 360°$

$\underline{180°} - \underline{a} + \underline{180°} - \underline{b} + \underline{180°} - \underline{c} = 360°$

$540° - a - b - c = 360°$

subtract 540°: $-a-b-c = -180°$

multiply −1: $\boxed{a+b+c = 180°}$

And we're done. ∎