Chapter 3 Review: Parallel and Perpendicular Lines

What'd we cover?

In this chapter we discovered 2 postulates and 10 theorems. While it may seem a bit overwhelming, if we look at them by groups, it really isn't so bad. These postulates and theorems can be grouped by their primary focus:

Group	Focus	What
Parallel lines ↓ Angle pairs	Given parallel lines, what can we say about the angles pairs formed by those two lines and a transversal	• 1 postulate • 2 theorems
Angle pairs ↓ Parallel lines	Given information about angle pairs formed by two lines and a transversal, determine if the two lines are parallel. This group is the converse of the 1st	• 1 postulate • 2 theorems
Lines ↓ Lines	How lines relate to each other (parallel or perpendicular)	• 2 theorems
Triangles	What we can know about the angles formed by a triangle?	• 2 theorems
Polygons	What we can know about the angles formed by general polygons?	• 2 theorems

Stop!

Before we take another step, let me be very clear: ***<u>you do not need to memorize these by number</u>*****!** You just need to be able to say what the theorem (or postulate) mean. For instance:

- Rather than saying "Postulate 3-1", you can say "Corr. $\angle 's$ of $\parallel$ lines are $\cong$."
- Rather than saying "Post 3-2", say "Conv. of corr. $\angle 's$ of $\parallel$ lines are $\cong$."

Now if memorizing by number is easier for you, by all means have at it. For me, it is far easier to remember the gist of the theorem. I suspect that you can state most of the postulates and theorems in this way.

You want an example? Every single one of you can tell me that "vertical angles are congruent." How many of you can tell me what Postulate 2-1 says? Not many I'm sure. Well, that statement **<u>is</u>** Postulate 2-1. You are just fine saying "vert. $\angle 's$ are $\cong$."

Group 1: Parallel lines→Angle Pairs

If we know that two lines are parallel, what can we say about the angle pairs formed by a transversal?

1. Corresponding angles are congruent (Postulate 3-1)

2. Alternate interior angles are congruent. (Theorem 3-1)
3. Same-side interior angles are supplementary. (Theorem 3-2)

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Group 2: Angle Pairs →Parallel lines

If we know certain things about angle pairs formed by two lines and a transversal, can we determine if the two lines are parallel?

1. Yes, if corresponding angles are congruent. (Postulate 3-2)

2. Yes, if alternate interior angles are congruent. (Theorem 3-3)
3. Yes, if same-side interior angles are supplementary. (Theorem 3-4)

Be careful!

It is important that when you are using any of these from group 1 or 2 that you identify the starting (or given) information:

- If you know (or assume) that the lines are parallel and want to prove (or find) angle pair info, then use group 1.
  - Example: Line $r \parallel t$; find $m\angle 1$ and $m\angle 2$.
  - Example: Find the value of x if $m \parallel l$, $m\angle 3 = 3x - 73$ and $m\angle 5 = 5x + 12$.
  - Example: Find the value of x for line l to be parallel to m.

- If you know info about angle pairs and want to prove that lines are parallel, use group 2.
  - Example: Given $m\angle 1 = m\angle 2$, what must be true?
  - Example: Given $\angle 2 \cong \angle 6$ prove $p \parallel r$.

So, if you are given a diagram **make sure you know what you are starting with and what you want to prove.**

Remember your special diagram markings!

If you are shown a diagram, don't make assumptions unless you have the necessary markings! Remember, you **must** have special markings to conclude the following:

1. angles or segments are congruent
2. right angles
3. lines are parallel or perpendicular

Group 3: Lines→Lines

If we are given information about how two lines relate to a third, can we say they are parallel?

1. Yes, if two lines are parallel to a third line. (Theorem 3-5)
2. Yes, if two **coplanar** lines are perpendicular to the same line. (Theorem 3-6)

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Group 4: Triangles

Given a triangle, what can we say about the angles it forms?

1. The sum of the measures of its interior angles is 180. (Theorem 3-7)
2. The measure of an exterior angle equals the sum of the measures of its remote interior angles. (Theorem 3-8)

Group 5: General Polygons

Given a general polygon with ***n*** sides (an *n*-gon), what can we say about the angles it forms?

1. The sum of the measures of its interior angles is $(n\text{-}2)180$. (Theorem 3-9)
2. The sum of the measures of its exterior angles is 360. (Theorem 3-10)

Many problems in this category will involve a **regular polygon**.

1. Given one interior angle measure x you can determine the number of sides:
   $n \cdot x = (n - 2)180$, solve for n (x is known)

2. Given the number sides n you can determine the measure of an interior angle:
   $m\angle = \frac{(n-2)180}{n}$ (total angle measure divided by the number of sides)

3. Given the sum S of the interior angles, you can determine the number of sides:
   $S = (n - 2)180$, solve for n (S is known)

The same problems can be posed but using external instead of internal angles. Just use the Theorem 3-10 formula instead.

Slope and linear equations

Slope is "rise over run." It indicates steepness and direction of slant. The greater the slope, the steeper the line. A positive slope slants up (/) from left to right. A negative slope slants down (\) from left to right.

You need two points to determine slope. Rise is the difference in *y*-coordinates. Run is the difference in *x*-coordinates. So given $(x_1, y1)$ and $(x_2, y2)$:

$$\text{Slope} = m = \frac{y_2 - y_1}{x_2 - x_1}$$

Slope-intercept form

$y = mx + b$ where m = slope, and b is the *y*-intercept $(0, b)$.

To plot the line, plot the *y*-intercept and use slope (rise over run) to find the 2nd point.

Use this form to come up with the line equation if given the slope and *y*-intercept.

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Standard form

$Ax + By = C$ where $A, B, \& C$ are real numbers, and $A \& B$ are not both zero.

To plot the line, plot the x-intercept: plug in 0 for y, solve for x giving the point $(x, 0)$
then plot the y-intercept: plug in 0 for x, solve for y giving the point $(0, y)$.

You can also transform the standard form to the slope-intercept form by solving for y.

Point-slope form

$y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point the line contains.

This form is most useful for writing the line equation given the slope and one point.

If you are given two points, calculate the slope from the two points, then pick one of the points and use the point-slope form.

Form of vertical lines

$x = b$ is the vertical line through the point (a, b).

The line only crosses the x-axis so it is $x = \ldots$

Form of horizontal lines

$y = a$ is the horizontal line through the point (a, b).

The line only crosses the y-axis so it is $y = \ldots$

Slopes of parallel lines

The slopes of parallel lines are equal.

Slopes of perpendicular lines

The product of the slopes of perpendicular lines is -1.

Assigned homework

p. 157 #70-80
p. 164 #1-10
p. 170 #41-47
p. 176 #3-14, 19, 20, 22-28