Section 2.0 Review

Define:

- **Parallel Lines**

  \[ \text{lines never meet} \]

- **Quadrilateral**

  \[ \text{any four-sided figure must be closed} \]

- **Kite**

- **Rhombus**

  \[ \text{all sides are equal angles are not 90°} \]

- **Parallelogram**

  \[ \text{a rectangle someone kicked} \]

- **Acute Triangle**

  \[ \text{all angles are less than 90°} \]

- **Obtuse Triangle**

  \[ \text{one angle is greater than 90°} \]

- **Equilateral Triangle**

  \[ \text{all sides are equal. All angles are 60°} \]
- Scalene Triangle
  No sides are equal

- Isosceles Triangle
  Two sides are equal
  Two angles are equal

- Supplementary Angles (180)
  \[ a + b = 180^\circ \]

- Complementary Angles (90)
  \[ a + b = 90^\circ \]

Similar Triangles
  Two triangles that have the same angle measures.

Congruent Triangles
  “Equal”
  Same length + angles
  \[ \triangle A \equiv \triangle B \]
  “congruent”

Vertically Opposite Angles
  \[ \angle a = \angle c \]
  \[ \angle b = \angle d \]

From <https://rcsdtech-my.sharepoint.com/personal/s_thibeault_rcsd_ca/Documents/3%20Foundations%2020/Unit%202%20-%20Angles/Section%202.0%20Review%20.docx>
Calculate \( \angle a, \angle b, \angle c \).

\( \angle b = 65^\circ \) vertically opp.

\( \angle c = 180^\circ - \angle c = 115^\circ \) supp. angles

\( \angle a = 115^\circ \) vert. opp.

p. 38 \# 1-6 all.
Geometric Properties Review

**Angle Properties**

<table>
<thead>
<tr>
<th>Acute</th>
<th>$&lt; 90$</th>
<th>Straight</th>
<th>Angles at a point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtuse</td>
<td>$&gt; 90$</td>
<td>Angles on a line</td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>$= 90$</td>
<td>Vertically opposite angles</td>
<td></td>
</tr>
<tr>
<td>Perpendicular</td>
<td>Bisect</td>
<td>Diagonal</td>
<td></td>
</tr>
</tbody>
</table>

**Triangle Properties**

Parallel lines and Transversals

A *transversal* is a line that intersects two or more other lines at distinct points.

**Parallel lines** are lines with the same slope, but different y-intercepts. Parallel lines will never intersect each other.

If two parallel lines are cut by a transversal, eight angles are created.

**Interior Angles** lie inside the parallel lines.
Exterior angles lie outside the parallel lines.

Corresponding angles are one interior angle and one exterior angle that are non-adjacent and on the same side of the transversal.

If two parallel lines are cut by a transversal, then corresponding angles are equal.

Likewise, if two lines are cut by a transversal and the corresponding angles are equal, then the lines are parallel.

Example 1: Find the indicated angle.
2.2 - Angles formed by Parallel Lines

- The first column contains statements we believe are true.
- The second column contains the reason for the statement (how do we know it’s true?)
- These statements and justifications involve known facts about:
  - corresponding angles (they are equal)
  - vertically opposite angles (they are equal)
  - complementary angles (together they form a right angle)
  - supplementary angles (together they form a straight angle)
  - The transitive property can be used: if a = b and b = c, then a = c

Prove the following conjectures:

1) "When parallel lines are intersected by a transversal, the alternate interior angles are equal.”
Create a diagram:

What are you trying to prove?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha = \beta )</td>
<td>Corresponding angles</td>
</tr>
<tr>
<td>( \gamma = \delta )</td>
<td>Vertically opposite angles</td>
</tr>
<tr>
<td>( \therefore \alpha = \beta )</td>
<td>Transitive property</td>
</tr>
</tbody>
</table>

2) "When parallel lines are intersected by a transversal, the same-side interior angles are supplementary.”
Create a diagram:

What are you trying to prove?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha = \beta )</td>
<td>Corresponding angles</td>
</tr>
<tr>
<td>( \gamma = \delta )</td>
<td>Transitive property</td>
</tr>
<tr>
<td>( \therefore \alpha + \beta = 180^\circ )</td>
<td>Supplementary angles</td>
</tr>
</tbody>
</table>

3) "When parallel lines are intersected by a transversal, the alternate exterior angles are equal.”
Create a diagram:

What are you trying to prove?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha = \gamma )</td>
<td>Corresponding angles</td>
</tr>
<tr>
<td>( \therefore \alpha = \gamma )</td>
<td>Transitive property</td>
</tr>
</tbody>
</table>

Results

Note that we have proved these statements are true, we can use them in other proofs!
Results

Now that we have proved these statements are true, we can use them in other proofs!

1. Corresponding angles are equal
2. Alternate interior angles are equal
3. Alternate exterior angles are equal
4. Same side interior angles are supplementary
5. Vertically opposite angles are equal

Examples

From https://rcsdtech-my.sharepoint.com/personal/s_thibeault_rcsd_ca/Documents/3%20Foundations%2020/Unit%202-20Angles/notes2.2.docx

Chapter 2 - Angles Page 7
2.3- Angle Properties in Triangles

Key Terms:

1) Exterior angle (of a triangle, or other polygon):

The angle that is formed by a side of a triangle, or other polygon, and the extension of an adjacent side

2) Non-adjacent interior angles (in a triangle):

- The two angles of a triangle that do not have the same vertex as an exterior angle

Triangle Property #1:

The sum of the measure of the interior angles of any triangles is 180°.
Triangle Property #2:

The measure of any exterior angle of a triangle is proven to be equal to the sum of the measure of the two non-adjacent interior angles.

\[ a + b = x \]

Examples:

Determine the angle measures in the following triangle:

\[ 135 - 60 = 75^\circ \]
\[ 180 - 135 = 45^\circ \]

Prove AB // CD:

Find the angles:

\[ 180 - 93 = 87^\circ \]
\[ 180 - 87 - 48 = 43 = 48 + x \]

Prove AB // CD.
The sum of the angles in a triangle is $180^\circ$.

We can use our knowledge of parallel lines to prove this theorem.

**Example 1.** Given $\triangle ABC$, prove $\angle 1 + \angle 2 + \angle 3 = 180^\circ$.

**Example 2.** Determine the measures of $\angle 1$ and $\angle 2$. 

180 - 140 = 40°
40° = α
The measure of an exterior angle of a triangle is equal to the sum of the measures of the two non-adjacent interior angles.

Example 3. Prove \( \angle e = \angle a + \angle b \).

Example 4. Determine \( \angle 1, \angle 2, \angle 3, \) and \( \angle 4 \).
\[ 180 - 90 - 30 = 60^\circ \]

\[ 180 - 60^\circ = 120^\circ \]
2.4 Angle Properties in Polygons

Key Terms:

1) Convex polygon: a polygon in which each interior angle measure less than 180°.

   Example: Non-example:

2) Regular polygon: a regular polygon for which all sides are equal length, and all interior angles have the same measure.

   Some regular polygons are so special, they have their own name:

   a regular triangle is called an equilateral triangle

   a regular quadrilateral is called a square

Other regular polygons are simply referred to by the name dictated by the number of sides, with the word “regular” in front:
a regular pentagon (penta = 5 sided)

a regular hexagon (hexa = 6 sided)

a regular octagon (octa = 8 sided)

---

**Polygon Names**

<table>
<thead>
<tr>
<th>Polygon Names</th>
<th>Number of sides (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle</td>
<td>3 sides</td>
</tr>
<tr>
<td>Quadrilateral</td>
<td>4 sides</td>
</tr>
<tr>
<td>Pentagon</td>
<td>5 sides</td>
</tr>
<tr>
<td>Hexagon</td>
<td>6 sides</td>
</tr>
<tr>
<td>Heptagon</td>
<td>7 sides</td>
</tr>
<tr>
<td>Octagon</td>
<td>8 sides</td>
</tr>
<tr>
<td>Nonagon</td>
<td>9 sides</td>
</tr>
<tr>
<td>Decagon</td>
<td>10 sides</td>
</tr>
<tr>
<td>Dodecagon</td>
<td>12 sides</td>
</tr>
<tr>
<td>n-gon</td>
<td>n sides</td>
</tr>
<tr>
<td>Ex. 15-gon</td>
<td>15 sides</td>
</tr>
</tbody>
</table>

**Goal:** Use the fact that we know the interior angles of a triangle add up to 180° to help us come up with a formula that will calculate the **interior angle sum** for ANY convex polygon with ANY number of sides (n).

**Polygon Formula #1:**

The interior angle sum for any convex polygon:

\[ \text{IAS} = (n - 2) \times 180° \]

**Polygon formula #2:**

The exterior angle sum (EAS) for any convex polygon is always 360°, regardless of how many sides it has!
Polygon formula #2:
The exterior angle sum (EAS) for any convex polygon is always 360°, regardless of how many sides it has!

EAS = 360°

Polygon formula #3:
(regular polygons only)
Recall: each interior angle of a regular polygon has the same measure.
Each interior angle (EIA) for regular polygons can be found by dividing the interior angle sum by the number of angles in the polygon. (The number of angles is the same as the number of sides)

\[ \text{EIA} = \frac{180°(n - 2)}{n} \]  
\( n = \text{number of sides} \)

Polygon formula #4
(regular polygons only)
Each exterior angle (EEA) for regular polygons can be found by dividing the exterior angle sum (always 360°) by the number of angles in the polygon. (The number of angles is the same as the number of sides)

\[ \text{EEA} = \frac{360}{n} \]  
\( n = \text{number of sides} \)

Examples:
Show that the exterior angle sum for a triangle is 360°.

\[ 120° + 120° + 120° = 360° \]

\[ \text{Hepta} = 7 \text{ sides} \]
\[ S = 180(n - 2) \]
\[ S = 180(7 - 2) \]
\[ S = 180(5) \]
\[ S = 900° \]

2.4 Cont'd
Let’s look at how big each interior angle is in a regular polygon:

\[ a = \frac{180(5 - 2)}{5} \]
\[ = \frac{180(3)}{5} = 108° \]

\[ a = \frac{180(4 - 2)}{4} \]
\[ = 90° \]

\[ a = \frac{180(6 - 2)}{6} \]
\[ = \frac{180(4)}{6} = 120° \]
# of angles: 
Measure of each: 

Formula for interior angle of a regular polygon:

\[ a = \frac{180(n-2)}{n} \]  

Exterior Angles: always look at them from one direction, clockwise or counter-clockwise.

Clockwise Counter-Clockwise

Each interior angle has an exterior angle that forms a straight line making 180°. To find the exterior sum, we can add all:

\[ E = \frac{360}{n} = \frac{360}{5} = 72° \]

\[ E = 180 - IA = 180° - 108° = 72° \]

* For shapes to tesselate, the exterior angles MUST add up to 360°.
A convex polygon has an exterior angle sum of: **360°**

**Theorem:** The sum of the exterior angles of any convex polygon is 360°.

Show that each exterior angle of a regular polygon is

1. Draw an Octagon (8 sided), hexagon (6 sided), and a pentagon (5 sided). Then add on the exterior angles in each polygon.

<table>
<thead>
<tr>
<th></th>
<th>Octagon</th>
<th>Hexagon</th>
<th>Pentagon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="image" alt="Octagon Diagram" /></td>
<td><img src="image" alt="Hexagon Diagram" /></td>
<td><img src="image" alt="Pentagon Diagram" /></td>
</tr>
</tbody>
</table>

2. Find the sums of the interior angles for each

<table>
<thead>
<tr>
<th></th>
<th>Octagon</th>
<th>Hexagon</th>
<th>Pentagon</th>
</tr>
</thead>
<tbody>
<tr>
<td>S = 180(n - 2)</td>
<td><img src="image" alt="Octagon Interior Angle Calculation" /></td>
<td><img src="image" alt="Hexagon Interior Angle Calculation" /></td>
<td><img src="image" alt="Pentagon Interior Angle Calculation" /></td>
</tr>
</tbody>
</table>

3. Find the measure of the interior angles for each

<table>
<thead>
<tr>
<th>Octagon</th>
<th>Hexagon</th>
<th>Pentagon</th>
</tr>
</thead>
<tbody>
<tr>
<td>( a = \frac{180(n - 2)}{n} )</td>
<td>( \frac{1080}{6} )</td>
<td>135°</td>
</tr>
</tbody>
</table>

4. Find the measure of the exterior angles for each

<table>
<thead>
<tr>
<th>Octagon</th>
<th>Hexagon</th>
<th>Pentagon</th>
</tr>
</thead>
<tbody>
<tr>
<td>( E = \frac{360}{n} )</td>
<td>45°</td>
<td><img src="image" alt="Exterior Angle Calculation" /></td>
</tr>
</tbody>
</table>

5. Find the answer to 360° divided by the number of sides for each polygon

<table>
<thead>
<tr>
<th>Octagon</th>
<th>Hexagon</th>
<th>Pentagon</th>
</tr>
</thead>
<tbody>
<tr>
<td>45°</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Compare the results in step 5 to the results in step 4

7. List your observations of the results from step 6

- They are the same!

A convex polygon has all interior angles less than 180°. A concave polygon has at least one interior angle greater than 180°.
A convex polygon has all interior angles less than 180°.

A concave polygon has at least one interior angle greater than 180°.

Example 1. Determine the measure of each interior angle of a regular 17-sided polygon.

\[ a = \frac{180(n-2)}{n} = \frac{180(17-2)}{17} = \frac{180(15)}{17} = 158.8° \]

Exterior and Interior Angles:

1. \( E = \frac{360}{17} = 21.2° \)
2. \( E = 180 - 158.8 = 21.2° \)

From <https://rcsdtech-my.sharepoint.com/personal/s_tibeault_rcsd_ca/Documents/3%20%20Foundations/2020/Unit%2020%20-%20Angles/2.4%20Handout.docx>
2.1 – 2.2 Quiz

NAME: _________________________  Date: _________________________

1. Determine the measure of all unknown angles. Be sure to label them and show your work.

\[180 - 62 = 118^\circ\]

2. Are \(BD\) and \(FE\) parallel? Explain how you know.

\[125^\circ + 37^\circ = 162^\circ\]

\[\therefore \text{Not Parallel}\]
3. Prove: $TV \parallel YZ$

Because $\angle TUV$ is equal to $\angle UYZ$ (alt. int), $TV \parallel YZ$.

4. Prove $\angle C = \angle D$.

$\angle C = \angle 2$

$\angle 2 = \angle D$

$\therefore \angle C = D$
Math 20 Ch 2 Quiz

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. Which pairs of angles are equal in this diagram?

- a = b, e = c, and e = f
- a = e, c = g, and b = f
- a = c, e = g, and f = h
- a = e, b = d, and c = g

2. Which pairs of angles are equal in this diagram?

- b = c, c = h, and d = g
- b = a, c = e, and d = f
- h = c, e = g, and f = h
- b = f, c = g, and d = h

3. In which diagram(s) is AB parallel to CD?

- Choice 1 only
- Choice 2 only
- Choice 1 and Choice 2
- Neither Choice 1 nor Choice 2
4. In which diagram(s) is $AB$ parallel to $CD$?

- 1. 
- 2.

a. Choice 1 only
b. Choice 2 only
**c. Choice 1 and Choice 2**
d. Neither Choice 1 nor Choice 2

5. Which statement about the angles in this diagram is false?

- $\angle b = 50^\circ$
- $\angle c = 50^\circ$
- $\angle e = 130^\circ$
- $\angle f = 62^\circ$

6. Which statement about the angles in this diagram is false?

- $\angle a + \angle c = 180^\circ$
- $\angle e + \angle d = 180^\circ$
**b. $\angle e + \angle d = 180^\circ$**
- $\angle d + \angle b = 124^\circ$
- $180^\circ - \angle f = 118^\circ$
7. Which statement about the angles in this diagram is false?

![Diagram with angles labeled](image)

- $\angle e = \angle f$
- $\angle a = \angle b$
- $\angle d = \angle c$
- $\angle f = \angle a$

8. Which angle property proves $\angle PYD = 90^\circ$?

- corresponding angles
- alternate interior angles
- alternate exterior angles
- supplementary angles

9. Which angle property proves $\angle DAB = 120^\circ$?

- vertically opposite angles
- alternate exterior angles
- alternate interior angles
- corresponding angles
10. Which angle property proves $\angle BED = 73^\circ$?

   ![Diagram showing angles and relationships]

   a. alternate interior angles  
   b. vertically opposite angles  
   c. corresponding angles  
   d. alternate exterior angles

11. In which diagrams are two lines parallel?

   ![Diagram with angles marked]

   1.  
   2.  
   3.  

   a. Choices 1, 2, and 3  
   b. Choice 1 and Choice 3  
   c. Choice 2 and Choice 3  
   d. Choice 1 only

12. In which diagrams are two lines parallel?

   ![Diagram with angles marked]

   1.  
   2.  
   3.  

   a. Choice 2 and Choice 3  
   b. Choice 1 only  
   c. Choice 1 and Choice 3  
   d. Choices 1, 2, and 3

13. Which are the correct measures of the indicated angles?

   ![Diagram with angles marked]

   a. $\angle w = 146^\circ$, $\angle x = 44^\circ$, $\angle y = 146^\circ$  
   b. $\angle w = 134^\circ$, $\angle x = 46^\circ$, $\angle y = 46^\circ$  
   c. $\angle w = 136^\circ$, $\angle x = 44^\circ$, $\angle y = 136^\circ$  
   d. $\angle w = 116^\circ$, $\angle x = 64^\circ$, $\angle y = 64^\circ$
14. Which are the correct measures for $\angle YXZ$ and $\angle XZY$?

- $\angle YXZ = 63^\circ$, $\angle XZY = 91^\circ$
- $\angle YXZ = 53^\circ$, $\angle XZY = 91^\circ$
- $\angle YXZ = 63^\circ$, $\angle XZY = 81^\circ$
- $\angle YXZ = 53^\circ$, $\angle XZY = 81^\circ$

15. Which are the correct measures for $\angle YXZ$ and $\angle XZY$?

- $\angle YXZ = 52^\circ$, $\angle XZY = 77^\circ$
- $\angle YXZ = 52^\circ$, $\angle XZY = 87^\circ$
- $\angle YXZ = 62^\circ$, $\angle XZY = 77^\circ$
- $\angle YXZ = 62^\circ$, $\angle XZY = 87^\circ$

16. Which are the correct measures for $\angle DCE$ and $\angle CAB$?

- $\angle DCE = 47^\circ$, $\angle CAB = 109^\circ$
- $\angle DCE = 37^\circ$, $\angle CAB = 119^\circ$
- $\angle DCE = 13^\circ$, $\angle CAB = 143^\circ$
- $\angle DCE = 31^\circ$, $\angle CAB = 134^\circ$
17. Which are the correct measures of the interior angles of ΔCDE?

![Diagram of ΔCDE with angles 79° and 157°]

a. ∠DCE = 46°, ∠CDE = 101°, and ∠CED = 33°
b. ∠DCE = 32°, ∠CDE = 83°, and ∠CED = 65°
c. ∠DCE = 76°, ∠CDE = 91°, and ∠CED = 13°
d. ∠DCE = 56°, ∠CDE = 101°, and ∠CED = 23°

18. Which are the correct measures of the interior angles of ΔCDE?

![Diagram of ΔCDE with angles 121° and 131°]

a. ∠DCE = 92°, ∠CDE = 49°, and ∠CED = 39°
b. ∠DCE = 52°, ∠CDE = 69°, and ∠CED = 59°
c. ∠DCE = 62°, ∠CDE = 49°, and ∠CED = 69°
d. ∠DCE = 72°, ∠CDE = 59°, and ∠CED = 49°

19. Which are the correct measures for ∠WXZ, ∠UZY, and ∠VYX?

![Diagram of quadrilateral WXYZ with angles 33° and 67°]

a. ∠WXZ = 147°, ∠UZY = 118°, and ∠VYX = 95°
b. ∠WXZ = 147°, ∠UZY = 108°, and ∠VYX = 85°
c. ∠WXZ = 157°, ∠UZY = 118°, and ∠VYX = 95°
d. ∠WXZ = 157°, ∠UZY = 108°, and ∠VYX = 85°

Short Answer

20. Determine the measure of ∠ABF.

![Diagram of triangle ABD with angles 114°, 66°, and 42°]
21. Determine the measure of $\angle BEF$.

22. Determine the measure of $\angle DBF$.

23. Determine the measure of $\angle BDE$.

24. Determine the measure of $\angle PQT$. 
25. Determine the measure of \( \angle TRS \).

26. Determine the measure of \( \angle NMO \).

\[
\begin{align*}
75 - 22 &= 53^\circ \\
180 - 45 - 53 &= 82^\circ
\end{align*}
\]

27. Determine the unknown angles.

\[
\begin{align*}
180 - 40 - 79 &= 61^\circ \\
180 - 61 - 79 &= 40^\circ
\end{align*}
\]
Problem


![Diagram](image)

No.

$125 + 37 = 162 \neq 180^\circ$

NOT \parallel

29. Is quadrilateral $MATH$ a parallelogram? Explain.

![Diagram](image)

No.

$78 + 45 = 123^\circ$

$180 - 123 = 57^\circ$

$45 + 64 = 109^\circ$

$57 + 38 = 95^\circ$
Math 20 Ch 2 Quiz
Answer Section

MULTIPLE CHOICE

1. ANS: B PTS: 1 DIF: Grade 11 REF: Lesson 2.1
   OBJ: 1.1 Generalize, using inductive reasoning, the relationships between pairs of angles formed by transversals and parallel lines, with or without technology. 1.5 Verify, with examples, that if lines are not parallel the angle properties do not apply. TOP: Parallel lines
   KEY: parallel lines|transversals

2. ANS: D PTS: 1 DIF: Grade 11 REF: Lesson 2.1
   OBJ: 1.1 Generalize, using inductive reasoning, the relationships between pairs of angles formed by transversals and parallel lines, with or without technology. 1.5 Verify, with examples, that if lines are not parallel the angle properties do not apply. TOP: Parallel lines
   KEY: parallel lines|transversals

3. ANS: B PTS: 1 DIF: Grade 11 REF: Lesson 2.1
   OBJ: 1.1 Generalize, using inductive reasoning, the relationships between pairs of angles formed by transversals and parallel lines, with or without technology. 1.5 Verify, with examples, that if lines are not parallel the angle properties do not apply. TOP: Parallel lines
   KEY: parallel lines|transversals

4. ANS: C PTS: 1 DIF: Grade 11 REF: Lesson 2.1
   OBJ: 1.1 Generalize, using inductive reasoning, the relationships between pairs of angles formed by transversals and parallel lines, with or without technology. 1.5 Verify, with examples, that if lines are not parallel the angle properties do not apply. TOP: Parallel lines
   KEY: parallel lines|transversals

5. ANS: A PTS: 1 DIF: Grade 11 REF: Lesson 2.2
   OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. 1.4 Identify and correct errors in a given proof of a property involving angles. 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. 2.3 Solve a contextual problem that involves angles or triangles. 2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used. 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.
   TOP: Angles formed by parallel lines
   KEY: parallel lines|transversals|angles

6. ANS: B PTS: 1 DIF: Grade 11 REF: Lesson 2.2
   OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. 1.4 Identify and correct errors in a given proof of a property involving angles. 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. 2.3 Solve a contextual problem that involves angles or triangles. 2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used. 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.
   TOP: Angles formed by parallel lines
   KEY: parallel lines|transversals|angles

7. ANS: D PTS: 1 DIF: Grade 11 REF: Lesson 2.2
   OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. 1.4 Identify and correct errors in a given proof of a property involving angles. 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. 2.3 Solve a contextual problem that involves angles or triangles. 2.4
Construct parallel lines, using only a compass or a protractor, and explain the strategy used. | 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal. 

TOP: Angles formed by parallel lines

KEY: parallel lines| transversals| angles

8. ANS: A  PTS: 1  DIF: Grade 11  REF: Lesson 2.2

OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. | 1.4 Identify and correct errors in a given proof of a property involving angles. | 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. | 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. | 2.3 Solve a contextual problem that involves angles or triangles. | 2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used. | 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.

TOP: Angles formed by parallel lines

KEY: parallel lines| transversals| angles

9. ANS: A  PTS: 1  DIF: Grade 11  REF: Lesson 2.2

OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. | 1.4 Identify and correct errors in a given proof of a property involving angles. | 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. | 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. | 2.3 Solve a contextual problem that involves angles or triangles. | 2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used. | 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.

TOP: Angles formed by parallel lines

KEY: parallel lines| transversals| angles

10. ANS: A  PTS: 1  DIF: Grade 11  REF: Lesson 2.2

OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. | 1.4 Identify and correct errors in a given proof of a property involving angles. | 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. | 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. | 2.3 Solve a contextual problem that involves angles or triangles. | 2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used. | 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.

TOP: Angles formed by parallel lines

KEY: parallel lines| transversals| angles

11. ANS: C  PTS: 1  DIF: Grade 11  REF: Lesson 2.2

OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. | 1.4 Identify and correct errors in a given proof of a property involving angles. | 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. | 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. | 2.3 Solve a contextual problem that involves angles or triangles. | 2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used. | 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.

TOP: Angles formed by parallel lines

KEY: parallel lines| transversals| angles

12. ANS: D  PTS: 1  DIF: Grade 11  REF: Lesson 2.2

OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. | 1.4 Identify and correct errors in a given proof of a property involving angles. | 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. | 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. | 2.3 Solve a contextual problem that involves angles or triangles. | 2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used. | 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.

TOP: Angles formed by parallel lines

KEY: parallel lines| transversals| angles

13. ANS: B  PTS: 1  DIF: Grade 11  REF: Lesson 2.2

OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines,
including the sum of the angles in a triangle. | 1.4 Identify and correct errors in a given proof of a property involving angles. | 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. | 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. | 2.3 Solve a contextual problem that involves angles or triangles. | 2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used. | 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.

TOP: Angles formed by parallel lines

ANS: C

PTS: 1

DIF: Grade 11

REF: Lesson 2.3

OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. | 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. | TOP: Angles in triangles

KEY: angles in triangles

ANS: A

PTS: 1

DIF: Grade 11

REF: Lesson 2.3

OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. | 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. | TOP: Angles in triangles

KEY: angles in triangles

ANS: B

PTS: 1

DIF: Grade 11

REF: Lesson 2.3

OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. | 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. | TOP: Angles in triangles

KEY: angles in triangles

ANS: D

PTS: 1

DIF: Grade 11

REF: Lesson 2.3

OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. | 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. | TOP: Angles in triangles

KEY: angles in triangles

ANS: A

PTS: 1

DIF: Grade 11

REF: Lesson 2.3

OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. | 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. | TOP: Angles in triangles

KEY: angles in triangles

SHORT ANSWER

20. ANS:

$\angle ABF = 66^\circ$

PTS: 1

DIF: Grade 11

REF: Lesson 2.2

OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. | 1.4 Identify and correct errors in a given proof of a property involving angles. | 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. | 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. | 2.3 Solve a contextual problem that involves angles or triangles. | 2.4
Construct parallel lines, using only a compass or a protractor, and explain the strategy used. 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.

TOP: Angles formed by parallel lines KEY: parallel lines| transversals| angles

21. ANS:
\[ \angle BFE = 72^\circ \]

PTS: 1 DIF: Grade 11 REF: Lesson 2.2
OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. 1.4 Identify and correct errors in a given proof of a property involving angles. 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. 2.3 Solve a contextual problem that involves angles or triangles. 2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used. 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.

TOP: Angles formed by parallel lines KEY: parallel lines| transversals| angles

22. ANS:
\[ \angle DBF = 114^\circ \]

PTS: 1 DIF: Grade 11 REF: Lesson 2.2
OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. 1.4 Identify and correct errors in a given proof of a property involving angles. 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. 2.3 Solve a contextual problem that involves angles or triangles. 2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used. 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.

TOP: Angles formed by parallel lines KEY: parallel lines| transversals| angles

23. ANS:
\[ \angle BDE = 66^\circ \]

PTS: 1 DIF: Grade 11 REF: Lesson 2.2
OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. 1.4 Identify and correct errors in a given proof of a property involving angles. 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. 2.3 Solve a contextual problem that involves angles or triangles. 2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used. 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.

TOP: Angles formed by parallel lines KEY: parallel lines| transversals| angles

24. ANS:
\[ \angle a = 18^\circ, \angle b = 54^\circ, \angle c = 27^\circ \]

PTS: 1 DIF: Grade 11 REF: Lesson 2.2
OBJ: 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle. 1.4 Identify and correct errors in a given proof of a property involving angles. 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. 2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles. 2.3 Solve a contextual problem that involves angles or triangles. 2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used. 2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.
25. **ANS:**
\[ \angle a = 15^\circ, \angle b = 30^\circ, \angle c = 10^\circ \]

**TOP:** Angles formed by parallel lines  
**KEY:** parallel lines | transversals | angles

**PTS:** 1  
**DIF:** Grade 11  
**REF:** Lesson 2.2

**OBJ:** 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle.  
1.4 Identify and correct errors in a given proof of a property involving angles.  
2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning.  
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2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.

**TOP:** Angles formed by parallel lines  
**KEY:** parallel lines | transversals | angles

26. **ANS:**
\[ \angle PQT = 36^\circ \]

**PTS:** 1  
**DIF:** Grade 11  
**REF:** Lesson 2.2

**OBJ:** 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle.  
1.4 Identify and correct errors in a given proof of a property involving angles.  
2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning.  
2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles.  
2.3 Solve a contextual problem that involves angles or triangles.  
2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used.  
2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.

**TOP:** Angles formed by parallel lines  
**KEY:** parallel lines | transversals | angles

27. **ANS:**
\[ \angle TRS = 41^\circ \]

**PTS:** 1  
**DIF:** Grade 11  
**REF:** Lesson 2.2

**OBJ:** 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle.  
1.4 Identify and correct errors in a given proof of a property involving angles.  
2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning.  
2.2 Identify and correct errors in a given solution to a problem that involves the measures of angles.  
2.3 Solve a contextual problem that involves angles or triangles.  
2.4 Construct parallel lines, using only a compass or a protractor, and explain the strategy used.  
2.5 Determine if lines are parallel, given the measure of an angle at each intersection formed by the lines and a transversal.

**TOP:** Angles formed by parallel lines  
**KEY:** parallel lines | transversals | angles

28. **ANS:**
\[ \angle NMO = 82^\circ \]

**PTS:** 1  
**DIF:** Grade 11  
**REF:** Lesson 2.3

**OBJ:** 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines, including the sum of the angles in a triangle.  
2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning.  
**TOP:** Angles in triangles

**KEY:** angles | triangles

29. **ANS:**
\[ \angle ADE = 40^\circ, \angle EAD = 61^\circ, \angle ABC = 61^\circ, \angle BAD = 119^\circ, \angle CDA = 140^\circ \]

**PTS:** 1  
**DIF:** Grade 11  
**REF:** Lesson 2.3

**OBJ:** 1.2 Prove, using deductive reasoning, properties of angles formed by transversals and parallel lines,
including the sum of the angles in a triangle. 2.1 Determine the measures of angles in a diagram that involves parallel lines, angles and triangles, and justify the reasoning. TOP: Angles in triangles
KEY: angles triangles

PROBLEM

30. ANS:
\( \angle ABC = \angle FBD = 125^\circ \) Vertically opposite angles
\( \angle EFB + \angle FBD = 162^\circ \)
So, \( BD \) is not parallel to \( FE \) because the interior angles on the same side of the transversal are not supplementary.

PTS: 1 DIF: Grade 11 REF: Lesson 2.2
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TOP: Angles formed by parallel lines KEY: parallel lines transversals angles

31. ANS:
It is not a parallelogram. \( \angle AMF \) does not equal \( \angle MTH \), so alternate interior angles are not equal.

PTS: 1 DIF: Grade 11 REF: Lesson 2.3
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KEY: angles triangles