2 & 3 Dimensional Figures
2- & 3-Dimensional Figures

1. Which shape fits the description below?

   A figure with exactly one pair of perpendicular sides.

   X.  
   Y.  
   Z.  

   ○ A. Y  
   ○ B. Z  
   ○ C. X  
   ○ D. The shape is nonexistent.

2. Which shape fits the description below?

   A figure which has all obtuse interior angles.

   X.  
   Y.  
   Z.  

   ○ A. Y  
   ○ B. X  
   ○ C. Z  
   ○ D. The shape is nonexistent.

3. Which shape fits the description below?

   A quadrilateral with exactly 2 parallel sides.

   X.  
   Y.  
   Z.  

   ○ A. Y  
   ○ B. The shape is nonexistent.  
   ○ C. X  
   ○ D. Z

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4. Which shape fits the description below?

*A figure whose interior angles sum to 360°.*

- A. Y
- B. X
- C. Z
- D. The shape is nonexistent.

5. Which shape fits the description below?

*A triangle with angle measures of 40°, 100°, and 40°.*

- A. X and Z
- B. X
- C. Z
- D. Y

6. How many triangles exist with the given angle measures?

- A. More than one triangle exists with the given angle measures.
- B. Exactly one unique triangle exists with the given angle measures.
- C. No triangle exists with the given angle measures.

7. How many triangles exist with the given side lengths?

- A. Exactly one unique triangle exists with the given side lengths.
B. No triangle exists with the given side lengths.
   ○ C. More than one triangle exists with the given side lengths.

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8. Which of the following is true?
   ○ A. All of the other statements are false.
   ○ B. A triangle can be drawn with more than one right angle.
   ○ C. A triangle can be drawn with more than one acute angle.
   ○ D. A triangle can be drawn with more than one obtuse angle.

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9. How many triangles exist with the given side lengths?
    7 inches, 7 inches, 7 inches
   ○ A. More than one triangle exists with the given side lengths.
   ○ B. Exactly one unique triangle exists with the given side lengths.
   ○ C. No triangle exists with the given side lengths.

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10. How many triangles exist with the given side lengths?
    4 m, 4 m, 7 m
   ○ A. No triangle exists with the given side lengths.
   ○ B. Exactly one unique triangle exists with the given side lengths.
   ○ C. More than one triangle exists with the given side lengths.

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11. How many triangles exist with the given angle measures?
    55°, 45°, 90°
   ○ A. No triangle exists with the given angle measures.
   ○ B. Exactly one unique triangle exists with the given angle measures.
   ○ C. More than one triangle exists with the given angle measures.

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12. How many triangles exist with the given angle measures?
    60°, 60°, 60°
13. How many triangles exist with the given angle measures?

30°, 65°, 85°

- A. Exactly one unique triangle exists with the given angle measures.
- B. More than one triangle exists with the given angle measures.
- C. No triangle exists with the given angle measures.

14. How many triangles exist with the given side lengths?

3 cm, 5 cm, 9 cm

- A. More than one triangle exists with the given side lengths.
- B. No triangle exists with the given side lengths.
- C. Exactly one unique triangle exists with the given side lengths.

15. Which of the following is false?

- A. A triangle can be drawn with exactly one right angle.
- B. All of the other statements are true.
- C. A triangle can be drawn with exactly one obtuse angle.
- D. A triangle can be drawn with exactly one acute angle.

16. Which shape has the greatest number of parallel faces?
17. How many pairs of parallel faces does the shape below have?

18. Which shape or shapes have two polygonal bases that are parallel and congruent to each other?

19. How many pairs of perpendicular faces does the shape below have?

20. Which shape or shapes are symmetrical across a horizontal plane?
21. If a cube is divided into two equal parts by a plane that passes through two edges diagonal to each other, which of the following best describes the cross-section of the cube?

- A. Y
- B. Z
- C. W, X, Y, and Z
- D. W

22. If a plane slices a cube through three points that are equidistant from one of its vertices, which of the following best describes the cross-section of the cube?

- A. X
- B. Y
- C. Z
- D. W

23. If the cube shown above is sliced by a plane through vertices 1, 6, and 8, which of the following best describes the cross-section of the cube?
24. If a cube is divided into two equal parts by a plane parallel to a face of the cube, which of the following best describes the cross-section of the cube?

- A. X
- B. Z
- C. W
- D. Y

25. If a plane slices a rectangular prism through three points that are equidistant from one of its vertices, which of the following best describes the cross-section of the prism?

- A. Y
- B. Z
- C. X
- D. W

26. If the rectangular prism above is divided into two equal parts by a plane parallel to face CDHG, which of the following best describes the cross-section of the prism?

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27. If the rectangular prism above is divided into two equal parts by a plane parallel to face ABCD, which of the following best describes the cross-section of the prism?

- A. W
- B. X
- C. Z
- D. Y

28. If the square pyramid shown above is sliced by a plane parallel to the base, which of the following best describes the cross-section of the pyramid?

- A. Y
- B. X
- C. W
- D. Z
29. 
If the square pyramid shown above is sliced by a plane perpendicular to the base and passing through the top vertex, which of the following best describes the cross-section of the pyramid?

- A. Z
- B. W
- C. Y
- D. X

30. 
If the rectangular pyramid above is sliced by a plane parallel to the base, which of the following best describes the cross-section of the pyramid? (Note: The rectangular base is not a square.)

- A. Y
- B. Z
- C. X
- D. W

### Answers

1. A
2. A
3. A
4. B
5. B
6. A
7. A
8. B
9. B
10. B
11. A
12. B
13. B

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14. B
15. D
16. A
17. A
18. B
19. A
20. A
21. B
22. C
23. A
24. B
25. B
26. B
27. D
28. B
29. B
30. D

**Explanations**

1. The figure with exactly one pair of perpendicular sides is the triangle.

   Therefore, shape **Y** fits the description.

2. Of the shapes given, the figure which has all obtuse interior angles is the pentagon.

   Therefore, shape **Y** fits the description.

3. A quadrilateral with exactly 2 parallel sides is a trapezoid.

   Therefore, shape **Y** fits the description.

4. A figure whose interior angles sum to 360° is a quadrilateral.

   The only shape which is a quadrilateral is the parallelogram.

   Therefore, shape **X** fits the description.

5. A triangle with angle measures of 40°, 100°, and 40° is an isosceles triangle.

   An isosceles triangle is a triangle with two equal sides and two equal angles.

   Therefore, shape **X** fits the description.

6. The sum of the angles in a triangle is 180°, so the angles do form a triangle.

   Since two of the three angles are congruent, the triangle is an isosceles triangle. An infinite number of isosceles triangles exists with different side lengths.

   Therefore, **more than one triangle exists with the given angle measures.**

7. A triangle with no congruent sides is a scalene triangle. Only one scalene triangle with side lengths of 12 inches, 15 inches, and 18 inches exists.

   Therefore, **exactly one unique triangle exists with the given side lengths.**

8. An obtuse angle is greater than 90°, an acute angle is less than 90°, and a right angle is equal to 90°. Since the sum of the angles in a triangle is 180°, at least two of the angles must be acute.

   Therefore, it is true that a triangle can be drawn with more than one acute angle.

9. A triangle with three equal sides is an equilateral triangle. Only one equilateral triangle with side lengths of 7 inches exists.

   Therefore, **exactly one unique triangle exists with the given side lengths.**

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10. A triangle with two equal sides is an isosceles triangle. Only one isosceles triangle with side lengths of 4 m, 4 m, and 7 m exists.

Therefore, **exactly one unique triangle exists with the given side lengths.**

11. The sum of the angles in a triangle is 180°. These angles add up to more than 180°, so the angles do not form a triangle.

Therefore, **no triangle exists with the given angle measures.**

12. The sum of the angles in a triangle is 180°, so the angles do form a triangle.

Since all three angles are congruent, the triangle is an equilateral triangle. An infinite number of equilateral triangles exists with different side lengths.

Therefore, **more than one triangle exists with the given angle measures.**

13. The sum of the angles in a triangle is 180°, so the angles do form a triangle.

Since all three angles are different, the triangle is a scalene triangle. An infinite number of scalene triangles exists with different side lengths.

Therefore, **more than one triangle exists with the given angle measures.**

14. According to the Triangle Inequality theorem, the sum of any two sides must be greater than the third side.

Since the sum of 3 cm and 5 cm is less than 9 cm, the triangle does not exist.

Therefore, **no triangle exists with the given side lengths.**

15. An obtuse angle is greater than 90°, an acute angle is less than 90°, and a right angle is equal to 90°. Since the sum of the angles in a triangle is 180°, at least two of the angles must be acute.

Therefore, it is false that **a triangle can be drawn with exactly one acute angle.**

16. Two faces are parallel if they are always the same distance from each other and will never intersect. In the octagonal prism shown, the faces that are opposite each other are parallel, so it has 10 parallel faces.

Therefore, **W has the greatest number of parallel faces.**

17. Two faces are parallel if they are always the same distance from each other and will never intersect. In the octagonal prism shown, the faces that are opposite each other are parallel.

The prism has 8 rectangular faces that form 4 pairs of parallel faces. The 2 octagon bases of the prism are also parallel, so they form another pair of parallel faces.

Therefore, **the shape has 4 + 1 = 5 parallel faces.**

18. Two faces are parallel if they are always the same distance from each other and will never intersect. Two bases are congruent if they are the same size and shape.

The cylinder has two congruent faces, but since the faces are circles, they are not polygons. Out of the shapes shown, **W and Y have two polygonal bases that are parallel and congruent to each other.**

19. Faces that are perpendicular form a right angle where they intersect. In the pyramid shown, none of the faces form a right angle where they intersect.

Therefore, **the shape has 0 pairs of perpendicular faces.**

20. If a 3-dimensional shape is symmetrical across a plane, then the two parts of the shape formed when the shape is divided by a plane are identical.

Out of the shapes shown, **Y and Z are symmetrical across a horizontal plane, as shown below.**

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21. A cube is a 3-dimensional figure with six congruent square faces. The cube below is divided into two equal parts by a plane that passes through two edges diagonal to each other.

![Cube Diagram](image)

The cross-section created by the plane is a rectangle. Therefore, Z is the best choice.

![Rectangle Diagram](image)

22. A cube is a 3-dimensional figure with six congruent square faces. The cube below is sliced by a plane through three points that are equidistant from one of its vertices.

![Cube Diagram](image)

The cross-section created by the plane is an equilateral triangle. Therefore, Z is the best choice.

![Equilateral Triangle Diagram](image)

23. A cube is a 3-dimensional figure with six congruent square faces. The cube below is sliced by a plane through vertices 1, 6, and 8.

![Cube Diagram](image)
The cross-section created by the plane is an equilateral triangle. Therefore, X is the best choice.

24. A cube is a 3-dimensional figure with six congruent square faces. The cube below is divided into two equal parts by a plane parallel to a face of the cube.

The cross-section created by the plane is a square. Therefore, Z is the best choice.

25. A rectangular prism has three pairs of congruent rectangular faces. Below, the rectangular prism is sliced by a plane through three points that are equidistant from one of its vertices.

The cross-section created by the plane is an equilateral triangle. Therefore, Z is the best choice.
26. The rectangular prism shown has two congruent square faces and four congruent rectangular faces. Below, the rectangular prism is divided into two equal parts by a plane parallel to face CDHG.

Since face CDHG is a rectangle, the cross-section created by a plane parallel to it is also a rectangle. Therefore, **Y** is the best choice.

27. The rectangular prism shown has two congruent square faces and four congruent rectangular faces. Below, the rectangular prism is divided into two equal parts by a plane parallel to face ABCD.

Since face ABCD is a square, the cross-section created by a plane parallel to it is also a square. Therefore, **Y** is the best choice.

28. A square pyramid has a square base and four triangular faces that meet at a common point. The square pyramid below is sliced by a plane parallel to the base.

Since the base is a square, the cross-section created by the plane parallel to it is also a square. Therefore, **X** is the best choice.
29. A square pyramid has a square base and four triangular faces that meet at a common point. The square pyramid below is sliced by a plane perpendicular to the base and passing through the top vertex.

The cross-section created by the plane is an isosceles triangle. Therefore, W is the best choice.

30. A rectangular pyramid has a rectangular base and four triangular faces that meet at a common point. The rectangular pyramid below is sliced by a plane parallel to the base.

Since the base is a rectangle, the cross-section created by the plane parallel to it is also a rectangle. Therefore, W is the best choice.