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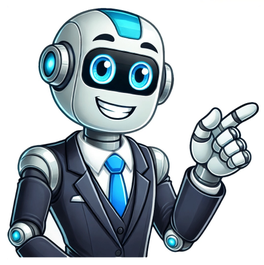

Switch to our new teaching resources now - designed by teachers and leading subject experts, and tested in classrooms.These resources were created for remote use during the pandemic and are not designed for classroom teaching.View new resourcesKey learning pointsIn this lesson, we will learn how to find an unknown angle in a polygon.This content is made available by Oak National Academy Limited and its partners and licensed under Oaks terms & conditions (Collection 1), except where otherwise stated.Q1.If I split a 7 sided shape into 5 triangles, I have done the correct process to find the total interior angles within the shape.Correct answer: TrueTrueQ2.Which of the following WOULD give you the total interior angles within a n-sided polygon?Correct answer: 180n - 360180n - 360Q3.Which of the following WOULD NOT give you the total interior angles of a n-sided polygon?Correct answer: 360n360nQ4.The sum of the total interior angles in a 30 sided shape is...Correct answer: 5040 degrees5040 degreesQ5.What would be the correct calculation to work out the total sum of the interior angles in a decagon?Correct answer: 180(10-2)180(10-2)Q1.A triangle is made up of the following: 73 degrees, 51 degrees and x degrees. Solve for x.Correct answer: 56 degrees56 degreesQ2.If a quadrilateral contains 3 right angles, what must the final angle be to form a quadrilateral?Correct answer: A right angleA right angleQ3.If the angles in a decagon are the following: 73 degrees, 293 degrees, 203 degrees, 9 degrees, 29 degrees, 184 degrees, 173 degrees, 93 degrees, 208 degrees, y degrees. Solve for y.Correct answer: 175175Q4.Is it possible to have two obtuse angles in a triangle?Correct answer: NoNoQ5.You are told that V + W + X + Y + Z = total interior sum of a pentagon. If V = 90 degrees, W = 110 degrees, X = 10 degrees, Y = 300 degrees, what would Z be?Correct answer: 3030To find a missing angle in a polygon, you can use the following steps:Step 1: Determine the total sum of the interior angles of the polygon.Step 2: Subtract the measures of the known angles from the total sum. The result will be the measure of the missing angle.Example:Calculate the value of @$\begin{align*}x\end{align*}@$in the figure.@$$\begin{align*}\text{Sum of interior angles of a pentagon} & = (n-2) \cdot 180^\circ \\x + 106^\circ + 93^\circ + 128^\circ + 76^\circ & = (5-2) \cdot 180^\circ \\x + 403^\circ & = 540^\circ \\x & = 540^\circ - 403^\circ \\x & = 137^\circ\end{align*}@$$Click here to learn more about polygons! 1 Expert Answer POLYGONS:You can find the sum of any polygon's interior angles by using the formula (n-2)*180, where n is the number of sides. For example, to find the sum of the interior angles of a pentagon with 5 sides (n=5), the sum of its interior angles is:(n-2)*180 = (5-2)*180 = 3*180 = 540 degreesThe sum of any polygon's exterior angles is always 360 degrees.For example, the sum of a pentagon's exterior angles is 360 degrees.REGULAR POLYGONS:Since a regular polygon has all sides and angles congruent, the measure of one interior angle is the sum of the interior angles divided by the number of sides: ((n-2)*180)/nFor example, the measure of one interior angle of a regular pentagon (n=5) is: ((n-2)*180)/n = ((5-2)*180)/5 = 540/5 = 108 degreesTo find the measure of one exterior angle in a regular polygon, divide the sum of the exterior angles (360 degrees) by the number of sides, n. For example, the measure of one exterior angle of a regular pentagon (n=5) is: 360/5 = 72 degreesPARALLELOGRAMS:The following properties of parallelograms can help you find missing sides/angles:Opposite sides are both congruent (same length) and parallel (remember angle relationships for parallel lines cut by a transversal when you have a diagonal drawn in)Opposite angles are congruent (same measure)Consecutive/adjacent angles are supplementary (add up to 180 degrees)Diagonals bisect each otherA diagram with markings illustrating the properties here: Note: Be careful when you are working with special parallelograms such as a rectangle, rhombus, or square, since they each have their own specific properties. An angle is a figure formed by two rays with the same initial point. In geometry, different names are given to different angels and their combinations depending upon the type of angles they make. Different geometrical shapes such as a triangle or a quadrilateral contain a set of angles that are governed by a set of rules. For example, there are three interior angles in a triangle, the sum of which is always equal to 180o. This means that if we are aware of two of the angles in a triangle we can find the third. Similarly using different rules and the available information we can find the missing angle in a geometrical figure. But, before understanding different situations where we can find the missing angles, we should first recall some of the properties of different geometric shapes that will be useful in finding missing angles. We know that there are three interior angles in a triangle. Let us see what are the different properties and the rules that define the relations between different angles in a triangle. The sum of the measure of the three interior angles of a triangle is always 180o. In the above triangle, x + y + z = 180o If one of the angles of a triangle is 90o, the sides that make the right angle are called the base and the perpendicular while the third side is called the hypotenuse. According to Pythagoras Theorem In a right-angled triangle, the square of the hypotenuse side is equal to the sum of squares of the other two sides. Mathematically, Base2 + Perpendicular2 = Hypotenuse2 Therefore, if a is the base, b is the perpendicular and c is the hypotenuse in a right angled triangle, then c2 = a2 + b2 According to this property, the exterior angleof a triangle is always equal to the sum of the interior opposite angles. For example, in the above triangle, the exterior angle a equals the sum of the interior angles b and c. a = b + c Let us now look at some of the angle properties in quadrilaterals. We know that A quadrilateral is a closed shape that is formed by joining four points among which any three points are non-collinear. In other words, a quadrilateral is a polygon made up of four sides. Let us see what are the different properties and the rules that define the relations between different angles in quadrilaterals. The sum of the measure of the three interior angles of a quadrilateral is always 360o. Therefore, in the above quadrilateral, ABCD, A + B + C + D = 360o Also, the sum of any two adjacent angles in a quadrilateral is equal to 180o. Following properties of angles in a square or a rectangle are relevant to finding missing angles in a figure. Theinterior angleof a square or a rectangle at each vertex is 90.The diagonals of a square or a rectangle bisect each other at 90. Sum of the interior angles of a pentagon (a quadrilateral having 5 sides) = 540o Sum of the interior angles of a hexagon (a quadrilateral having 6 sides) = 720o Complementary angles Two angles are said to be complementary if their sum is 90o. For example, two angles, 30o and 60o are complementary because their sum, 30o + 60o = 90o. Supplementary angles Two angles are said to be supplementary if their sum is 180o. For example, two angles, 130o and 50o are supplementary because their sum, 130o + 50o = 180o. Together, the supplementary angles form a straight line. Let l and m be two lines and let n be the transversal intersecting them at P and Q respectively as shown below Clearly, lines l and m make eight angles with the transversal n, four at P and four at Q. we have labelled them 1 to 8 for the sake of convenience and shall now classify them in the following groups The angles whose arms do not include the line segment PQ are called exterior angles. Therefore, in the above figure, angles 1, 2, 7 and 8 are exterior angles. The angles whose arms include the line segment PQ are called interior angles. Therefore, in the above figure, angles 6, 4, 5 and 6 are interior angles. A pair of angles in which one arm of both the angles is on the same side of the transversal and their other arms are directed in the same sense is called a pair of corresponding angles. In the above figure, there are four pairs of corresponding angles, 1 and 5, 2 and 6, 3 and 7, 4 and 8. We can also say that two angles on the same side of the transversal are known as corresponding angles if both lie either above the lines or below the two lines. A pair of angles in which one arm of each of the angles is on opposite sides of the transversal and whose other arms include segment PQ is called a pair of alternate interior angles. In other words, Alternate interior angles are angles formed when two parallel or non-parallel lines are intersected by a transversal. The angles are positioned at the inner corners of the intersections and lie on opposite sides of the transversal. In the above figures, 3 and 5 form a pair of alternate interior angles. Another pair of alternate interior angles in this figure is 4 and 6. A pair of angles in which one arm of each of the angles is on opposite sides of the transversal and whose other arms are directed in opposite directions and do not include segment PQ is called alternate exterior angles in a transversal. In the above figure, 2 and 8 form a pair of alternate exterior angles. Another pair of alternate exterior angles in this figure is 1 and 7. Now, let us use the above properties to find missing angles in different figures. Example 1 Find the measures of the angles x, y and z in the following figure Solution We have been a figure where some of the angles are known while we are required to find the values of the angles x, y and z. Now, let us consider the BEC. We know that the sum of the measure of the three interior angles of a triangle is always 180o. Therefore, BEC + EBC + ECB = 180o (1) Now, we have been given that, BEC = 90o ECB = 30o EBC = y Substituting these values in equation (1) we will get, y + 90o + 30o= 180o y + 120o= 180o y = 180o 120o y = 60o Now, let us consider AC. Again, we will use that property that the sum of the measure of the three interior angles of a triangle is always 180o. Therefore, ADC + ACD + DAC = 180o (2) Now, we have been given that, DAC = 50o ACD = 30o Substituting these values in equation (2) we will get, ADC + 50o + 30o= 180o ADC + 80o= 180o ADC = 180o 80o ADC = 100o Now that we know the value of ADC, we can find the value of ADB. We can see that ADC and ADE form a supplementary [air of angles. We also know that the sum of supplementary angles is always equal to180o. Therefore, ADC + ADE = 180o .. (3) We have been given that ADE = x and we have obtained above that ADC = 100o Substituting these values in equation (3) we will get, 100o + x = 180o x = 180o 100o x = 80o Now, let us consider the AOB. We can clearly see that the angle z is an exterior angle for the two angles x and y. by the definition of the exterior angle property of a triangle, The exterior angleof a triangle is always equal to the sum of the interior opposite angles. Therefore, we can say that z = x + y . (4) We have already obtained the values of and y above as x = 80o y = 60o Substituting these values in equation (4) we will get, z = 80o + 60o z = 140o Thus, we have the values of x, y and z we have as x = 80o y = 60o z = 140o Example 2 In the given figure, the lines l and m are parallel. n is a transversal and 1 = 40o. Find all the angles marked in the figure. Solution We have been given that lines l and m are parallel. n is a transversal and 1 = 40o. we need to find the remaining angles. Let us start with each angle one by one. First, let us find 2. We can clearly see that 1 and 2 form a supplementary pair of angles. This means that the sum of 1 and 2 should be equal to 180o. Hence, we have, 1 + 2 = 180o 40o + 2 = 180o 2 = 180o 40o 2 = 140o Now, that we have found the value of 2, we will find the value of 6 Note that 2 and 6 form a pair of corresponding angles. Since the lines that have been intersected by a transversal are parallel, therefore, the pair of corresponding angles should be equal. Hence, we have, 2 = 6 = 140o Similarly, 1 = 5 = 40o Note that 3 and 5 form a pair of alternate interior angles. Since the lines that have been intersected by a transversal are parallel, therefore, the pair of alternate interior angles should be equal. Hence, we have, 3 = 5 = 40o Similarly, 4 = 6 = 140o Similarly, we can see that 5 and 8 form a supplementary pair of angles. This means that the sum of 5 and 8 should be equal to 180o. Hence, we have, 5 + 8 = 180o 40o + 8 = 180o 8 = 180o 40o 8 = 140o Again, we can see that 6 and 7 form a supplementary pair of angles. This means that the sum of 6 and 7 should be equal to 180o. Hence, we have, 6 + 7 = 180o 140o + 7 = 180o 7 = 180o 140o 7 = 40o Hence, we have, 1 = 3 = 5 = 7 = 40o and 2 = 4 = 6 = 8 = 140o Example 3 Find the missing values in the following figure Solution We have been given a figure and we need to find the missing values in it. Let us first observe the angles that have been given to us. We have, TPX = 70o RQY = 60o Now, we can see that TPX and TPQ form a pair of supplementary angles. We know that the sum of the supplementary angles is always equal to 180o. Therefore, we have, TPX + TPQ = 180o . (1) Substituting the value of TPX in equation (1) we get, TPQ + 70o = 180o TPQ = 180o 70o TPQ = 110o which is the value of 1. Again, we can see that that RQP and RQY form a pair of supplementary angles. We know that the sum of the supplementary angles is always equal to 180o. Therefore, we have, RQP + RQY = 180o . (2) Also, RQY = 60o Subtituting the value of RQY in equation (2) we get, RQP + 60o = 180o RQP = 180o 60o RQP = 120o which is the value of 2 Now, if we see can see the figure enclosed by the points, P, Q, R, S and T form a pentagon. We also know that Sum of the interior angles of a pentagon is always equal to 540o. Therefore, we have, PQR + QRS + RST + STP + TPQ = 540o . (3) Also, we have, PQR = 120o (as calculated above) QRS = x (given in the question) RST = 30o (given in the question) STP = x (given in the question) TPQ = 110o(as calculated above) Substituting these values in equation (3), we will get, 120o + x + 30o +x + 110o = = 540o 2x + 260o = 540o 2x = 540o 260o 2x = 280o x = 140o Hence, the missing angles in the figure are x = 140o TPQ = 1 = 110o TPQ = 2 = 110o The sum of the measure of the three interior angles of a triangle is always 180o.If one of the angles of a triangle is 90o, the sides that make the right angle are called the base and the perpendicular while the third side is called the hypotenuse.The exterior angleof a triangle is always equal to the sum of the interior opposite angles.The sum of the measure of the three interior angles of a quadrilateral is always 360o.Sum of any two adjacent angles in a quadrilateral is equal to 180o.Theinterior angleof a square or a rectangle at each vertex is 90.The diagonals of a square or a rectangle bisect each other at 90.Sum of the interior angles of a pentagon (a quadrilateral having 5 sides) = 540oSum of the interior angles of a hexagon (a quadrilateral having 6 sides) = 720oTwo angles are said to be complementary if their sum is 90o.Two angles are said to be supplementary if their sum is 180o.Alternate interior angles are angles formed when two parallel or non-parallel lines are intersected by a transversal.A pair of angles in which one arm of each of the angles is on opposite sides of the transversal and whose other arms are directed in opposite directions and do not include segment PQ is called alternate exterior angles in a transversal. 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