I'm not a robot

A math grid is another name for the coordinate plane consisting of a space of small squares, sometimes with an x-axis and y-axis. Each little square is used as a measurement. Every square could measure one unit area or more depending on what is needed and what you decide. Each column or row of squares could also have a unique verbal title, like in the case of bar graphs (where each column has a different name). In this article, we will learn how to measure the area, describe it by using paths on a grid, and count them over a grid. How to Measure Area?Measuring area and describing paths on a grid is done using a square-sized box row. These boxes are equal in length and breadth. These can be used for drawing models of things, working out geometry and trigonometry problems, and for making calculations. Now let us see through an example:Here in the below image, we can see that the boxes are like graph paper having each of the boxes with equal sides. Let us suppose each box is of 1 unit. Therefore, there are 35 boxes. Here, by combining the length, it can be seen that it is 7 units.And the width is 5 units.So, we can say that the area of the whole box becomes:= 7 x 5= 35 unit2We can also find the area of the shaded portion. As each box is of 1 unit2.Since there are 9 shaded boxes.Hence, the area becomes 9 unit2 The Area of the Rectangle is the Number of Shaded Unit SquaresArea of RectangleConsider a yellow rectangle in the grid with an area of 6 units. ExampleIn the above figure, the length of the rectangle is 3 units, and the width is 2 units. The area of a rectangle can be obtained by multiplying its length and width, which is the same as counting the unit squares.Area of Rectangle = length × width Therefore, the required area is = 2 x 3 = 6 square unitsArea of SquareThe coloured square shown below in the grid occupies 25 squaresTherefore, the area of the square will be multiplied by its sides. Area of RectangleArea Of Square = side × side.So, the required area is = 5 x 5 = 25 square unitsPaths on a GridGiven Below is an 8 by 8 grid. Let Point A be at the top left corner of the square and point B be in the bottom right corner.If you are supposed to have only one more down and right and make a unique path in a grid, how many different paths will exist from A to B? Paths on GridEvery successful path for an 8x8 grid will involve exactly 7 moves down and 7 moves to the right. The number of decisions to select the right or the down path will determine the total number of paths. This way, we can count all possible paths from top left to bottom right.Counting PathsHow does one realise the many pathways on a square when three lines go across every way, from point A to point B (from top to bottom)?The problem, as declared, could be very little unclear as to wherever A and B are and what the rules are.Making an Orderly ListLet's number the points to make it easier to discuss:Starting at A=1, you have two choices, 2 or 4, so the possible paths so far are:1-21-4From 2, there are two choices, 3 or 5; from 4, there are two choices, 5 or 7:1-2-31-2-51-4-51-4-7From 3 or 7, there are no more choices; you're forced to go one way. From 5, you have two choices. So here are all the possible paths:1 - 2 - 3 - 6 - 91 - 2 - 5 - 6 - 91 - 2 - 5 - 8 - 91 - 4 - 5 - 6 - 91 - 4 - 5 - 8 - 91 - 4 - 7 - 8 - 9So we have a total of 6 paths (in red, from green A to red B): Counting PathsSolved ExamplesExample 1: Find the area of a square with a side of 5 cm.Solution: Area of a square = side × side.Here, side = 5 cmSubstituting the values, 5 × 5= 25Therefore, the area of the square = 25 sq cm.Example 2: The dimensions of a rectangle are 15 cm and 8 cm. Find its area.Solution: The area of a rectangle is the product of its length and width, which can be Given, length = 15cmWidth = 8Represented by the formula: Area = l × w.Substituting the given values, We get area of the rectangle = 15 × 8 = 120 square cmPractice QuestionsQ.1 Maggie's ping pong table is 9 feet long and 5 feet wide. What is the area of the rectangular playing surface of the ping pong table?28 square feet36 square feet45 square feet54 square feetAns. c. 45 square feetQ 2 The area of a rectangle with a base of 4 inches and a width of 5 inches is20 square inches.9 square inches.18 square inches.10 square inches. Ans. a.20 square inches SummaryIn this article, we have learnt about the area and how to find the area of various shapes and figures like squares and rectangles. Then we find their unique path in a grid, easily counting all possible paths from top left to bottom right. We have also solved some problems with them. This article also has a practice module that makes you practice the questions and helps you command the topic easily. Related Pages Illustrative Math Grade 8 Let's investigate the squares and their side lengths. Illustrative Math Unit 8.8, Lesson 1 (printable worksheets) The following diagram shows how we may find the area of a square but we don't know the side lengths. Lesson 1.1 Two Regions Which shaded region is larger? Explain your reasoning. See Video for Whole Lesson Lesson 1.2 Decomposing to Find Area Find the area of each shaded square (in square units). Are you ready for more? Any triangle with a base of 13 and a height of 5 has an area of 65/2. Both shapes in the figure have been partitioned into the same four pieces. Find the area of each of the piece and verify the corresponding parts are the same in each picture. There appears to be one extra unit of area in the right figure than in the left one. If all of the pieces have the same area, how is this possible? Show Answer The slope of the hypotenuse of the blue triangle is 3/8. The slope of the hypotenuse of the yellow triangle is 2/5. The slopes of the blue triangle and yellow triangle are not the equal and so the pieces don't really form a triangle. What is the side length of square A? What is its area? What is the side length of square C? What is its area? What is the area of square B? What is its side length? (Use tracing paper to check your answer to this.) Find the areas of squares D, E, and F. Which of these squares must have a side length that is greater than 5 but less than 6? Explain how you know. Lesson 1.4 Making Squares Use the applet to determine the total area of the five shapes, D, E, F, G, and H. Assume each small square is equal to 1 square unit. Open Applet Lesson 1 Practice Problems Find the area of each square. Each grid square represents 1 square unit. Find the length of a side of a square if its area is: a. 81 square inches b. 4/25 cm2 c. 0.49 square units d. m2 square units Find the area of a square if its side length is: a. 3 inches b. 7 units c. 100 cm d. 40 inches e. x units Evaluate (3.1 × 104) · (2 × 106). Choose the correct answer: Noah reads the problem, "Evaluate each expression, giving the answer in scientific notation." The first problem part is: 5.4 × 105 + 2.3 × 104. Noah says, "I can rewrite 5.4 × 105 as 54 × 104. Now I can add the numbers: 54 × 104 + 2.3 × 104." Do you agree with Noah's solution to the problem? Explain your reasoning. Select all the expressions that are equivalent to 38. The Open Up Resources math curriculum is free to download from the Open Up Resources website and is also available from Illustrative Mathematics. Try out our new and fun Fraction Concoction Game. Add and subtract fractions to make exciting fraction concoctions following a recipe. There are four levels of difficulty: Easy, medium, hard and insane. Practice the basics of fraction addition and subtraction or challenge yourself with the insane level. We welcome your feedback, comments and questions about this site or page. Please submit your feedback or enquiries via our Feedback page. A grid square on a map is a rectangular area defined by a network of intersecting lines, forming a pattern of squares or rectangles across the map's surface. These squares are a tool for dividing the map into manageable sections, allowing for a simplified way to identify and communicate specific locations. Think of them as a coordinate system overlaying the map, making it easier to reference areas independently of the underlying terrain or features. These grid systems aren't just lines on a map; they are an essential component of spatial awareness, enabling precise location identification across various scales and applications. The size of these squares can vary significantly, depending on the scale of the map and the precision required. Understanding the Purpose of Grid Squares At its core, the purpose of a grid square system is to provide a reference framework for locating points on a map. These systems are independent of the geographical coordinate system (latitude and longitude) and allow for more immediate and practical location referencing. They break down complex terrains into manageable, uniformly sized units, making it possible to quickly and accurately pinpoint locations. This is crucial in many different fields, from military operations and emergency services to hiking, land surveying, and amateur radio communications. By utilizing a grid reference, one can easily communicate a location with a level of precision that would be cumbersome or ambiguous using natural landmarks alone. Types of Grid Systems While the concept of a grid square is straightforward, several grid systems are employed depending on the region and application. Here are some of the most common: Maidenhead Locator System Also known as QTH locators, grid locators, or grid squares, the Maidenhead Locator System is commonly used in amateur radio to describe locations. Although referred to as "squares", these areas often appear distorted depending on the map projection used. This system divides the Earth into a grid composed of fields, squares, and even smaller units to precisely define locations. National Grid (UK) The Ordnance Survey (OS) National Grid system divides the United Kingdom into grid squares that are referenced with a numerical identifier. On OS maps, these squares are further divided into smaller squares using grid lines, typically representing 10-kilometer spacing. This system allows for the identification of 10-kilometer grid squares, which can be further refined to 1-kilometer or 100-meter squares using additional numbers. Universal Transverse Mercator (UTM) UTM coordinates are based on a grid system that divides the Earth into zones, each with its own set of easting and northing values. This system is widely used for topographical maps and military applications globally. Coordinates are always read right (eastings), then up (northings) and provide a precise location. Grid Square Dimensions and Scales The size of a grid square is not standard but depends heavily on the map's scale. When you see the term 'grid square', it could represent a square with a side length of 10 km, 1 km, 100 m, 10 m, or even 1 m, depending on the desired precision. Large-scale maps (e.g., 1:25,000) often feature grid lines that are 4cm apart, representing 1km x 1km squares. Medium-scale maps (e.g., 1:50,000) typically have grid lines 2cm apart, also representing 1km x 1km squares. Smaller-scale maps (e.g., 1:100,000) frequently have squares of 1cm^2, each representing 1 km^2. Detailed plans might use much smaller squares to indicate precise locations, for example 10m x 10m. Understanding the map's scale is essential when interpreting the size and meaning of grid squares. Reading Grid References Reading a grid reference involves identifying the coordinates of a location within the grid system. The process typically requires two sets of numbers, one relating to the horizontal position (easting), and the other to the vertical position (northing). The method generally consists of reading from left to right and then upwards (or eastings then northings). Four-figure grid references pinpoint a specific 1 km by 1 km square on a map. Six-figure grid references allow for locating a 100m by 100m square on the map. In all cases, the number of digits used indicates the level of precision involved. Frequently Asked Questions (FAQs) Here are some commonly asked questions that can further deepen understanding about grid squares on a map: 1. Are grid squares always square? While the term implies a square shape, grid squares are often rectangles due to the curvature of the Earth and the projection used to flatten it into a map. This is especially true on maps covering large geographical areas. However, for local maps, the distortion is negligible, and they appear very close to perfect squares. 2. Why use a grid system instead of latitude and longitude? Grid systems offer a more user-friendly approach for referencing positions on a map, particularly in situations where immediate and simple communication is required. Unlike latitude and longitude, grid references are often easier to read and communicate verbally. They also avoid the confusion of degrees, minutes, and seconds. 3. What is the difference between a four-figure and a six-figure grid reference? A four-figure grid reference identifies a 1 km by 1 km square. A six-figure grid reference provides more precision by defining a 100 m by 100 m square within the larger 1 km square. The additional two numbers allow more accurate positioning. 4. What is the purpose of the grid lines on a map? Grid lines are the visual representation of the grid system, forming the boundaries of the grid squares. These lines serve as a reference framework, allowing users to easily read and communicate grid references. They help divide the map into manageable sections. 5. Can grid squares be used on any map? While many maps use grid systems, the specific grid system and the size of the squares can vary. Ordnance Survey (OS) maps use the National Grid, while other maps might use UTM or a different system. You need to know which grid system is in use. 6. How do I calculate the area of a grid square? The area of a grid square depends on its dimensions. For example, a 1km x 1km square has an area of 1 square kilometer. On a 1:25,000 scale OS map, this square will measure 4cm x 4cm on the map. To calculate the area on the ground, use the map scale to convert the dimensions of the square from the map to real-world measurements. 7. What does 'easting' and 'northing' mean? Easting refers to the horizontal position in a grid coordinate, measuring how far a point is from a defined origin to the east. Northing refers to the vertical position, measuring how far a point is from a defined origin to the north. These are always read as right and up when specifying a location. 8. What is the 'principal digit' in a grid reference? The principal digits are the two or three numbers that identify the main grid lines on the map, usually associated with the larger, usually 1 km, squares. They are the first numbers read when interpreting grid coordinates. They are also called the main grid numbers. 9. How do you teach kids about map grids? Children can learn that a grid is a pattern of lines that form squares on a map. Start with a simple grid pattern and have them locate objects within the squares. Explain that grids help find places on a map more easily. Use colorful and interactive activities to make the learning process fun and engaging. 10. Is there a difference between a grid square and a map tile? While both grid squares and map tiles divide a map into sections, they are used differently. Grid squares are part of a geographic coordinate system, while map tiles are used for digital mapping and web display. Tiles are typically rectangular in form and used by mapping softwares. 11. Do grid systems have to be square? Not necessarily. While the most common grid layout is square or rectangular, grids can be adapted depending on the application. However, square grids are especially good for situations requiring precision. 12. How many grid squares are there globally using the Maidenhead system? The Maidenhead system divides the Earth into 32,400 grid squares. These are defined by 18 bands of longitude and latitude, creating a world grid of 324 fields, which are then further subdivided. 13. Can I use grid references with a GPS? Yes, many GPS devices are capable of displaying your location using a grid reference, such as the UTM system. It's necessary to select the correct grid system for the device to accurately display and communicate the reference. 14. How does a map scale affect the size of the grid square? The scale of the map determines how much of the Earth's surface is represented in a given area on the map. A larger scale map (e.g., 1:25,000) will show a smaller area with more detail and will have smaller grid squares on the ground compared to a smaller scale map (e.g., 1:100,000). 15. What is the most common grid layout used in design? In design, column grids are the most common type of grid used by graphic and web designers. These grids utilize a number of columns to align text and other design elements. However, grid squares are more commonly used in map applications. The area of a square is the space or region enclosed by the square's boundary. As you can see in the following illustration, the colored region within the boundary is the area of the square. For emphasis, the borders are colored green, while the area is colored orange/yellow. Intuitively, the area of a square can be calculated by counting the number of unit squares that are needed to entirely fill or cover the space of the square. In the diagram below, a large square with a side length of [latex]5[/latex] units can fit [latex]25[/latex] small squares such that each smaller square has a side length of [latex]1[/latex] unit. Loosely speaking, the number of little congruent squares that cover the space within the big square is square's area. As a result, the area is [latex]25[/latex] square units. How do we find the area of a square using a formula? First, let's recognize that a square is a special type of rectangle. Remember, the area of rectangle is the product of its length and width. [latex]A = lw[/latex] But in the case of square, the length is equal to the width. [latex]l = w[/latex] So, we can express the formula of the area either in terms of the length [latex]l[/latex] or width [latex]w[/latex]. [latex]A = \left(l \right)\left(l \right) = {l^2}[/latex] [latex]\\[/latex] [latex]A = \left(w \right)\left(w \right) = {w^2}[/latex] Yet, when discussing squares, the terms "length" and "width" are interchangeable and can lead to misunderstandings because they refer to the same thing. It is preferable to refer to the length or width as simply the side [latex]s[/latex] in order to avoid any confusion. We can simplify the formula by replacing [latex]l[/latex] for length or [latex]w[/latex] for width by [latex]s[/latex] to mean side. [latex]l \to s[/latex] [latex]\\[/latex] [latex]w \to s[/latex] Therefore, the formula of the area of square becomes [latex]A = \left(s \right)\left(s \right) = {s^2}[/latex] Let's go over some examples! Examples of Finding Area of Square on a Grid Example 1: Find the area of the square below on a grid. To find the area of a square on a grid paper, simply count the number of smaller squares contained within the larger square whose area you wanted to determine. Let's begin at 1 and keep going until we've counted all the squares. We will record the numbers in the squares to keep track of the total number of squares. Since there are 36 small squares that cover the big square, it implies that the area of the square is 36 square units. Example 2: What is the total area of the two squares on the grid? This is a very similar problem to Example 1. The only difference is that we now have two squares instead of one. Since we are interested in finding the total areas of the two squares, we must first determine the area of each square and then add them together to arrive at the final answer. Let's count the number of little squares in each huge square, the green and blue squares. Please refer to the diagram below. Because the green square comprises 25 little squares, its area is 25 square units. The blue square, on the other hand, has 9 little squares, thus its area is 9 square units. Finally, to get the overall area, add the areas of the green and blue squares which gives us 25 + 9 = 34. Therefore, the total area is 34 square units. To find the area of a square when the side [latex]s[/latex] is given, simply multiply the side by itself [latex]s \times s[/latex] or square it [latex]s^2[/latex]. Example 3: Find the area of a square whose side length is [latex]7[/latex] [latex]ft[/latex]. A square is a specific case of a rectangle in which the length [latex]l[/latex] and width [latex]w[/latex] are the same. Since the length and width have the same measure, let's simply call it as side [latex]s[/latex]. Below is the illustration of the given problem. Notice, both sides have the same measure of [latex]7[/latex] [latex]ft[/latex]. To find the area of the square, we multiply the two sides together. [latex]A = s \times s = 7 \times 7 = 49[/latex][latex]\,[/latex]unit[latex]^2[/latex] Or simply square the side. It will have the same result. [latex]A = {s^2} = {\left(7 \right)^2} = 49[/latex][latex]\,[/latex]unit[latex]^2[/latex] Therefore, the area of the square is 49 square units. Example 4: The side of a square is [latex]1[/latex] yard. What is the area of the square in square inches? Don't jump to the conclusion that the solution is [latex]1[/latex] square yard since side times side equals 1, that is, [latex]\left(1 \right)\left(1 \right) = 1[/latex]. If the problem is asking for the area in square yards, you are correct. But this is not the case. Clearly, the question is asking for the area in terms of square inches not in square yards. That is why we must approach each problem with caution. The key is to thoroughly and carefully read the question and to ensure that we understand what is being asked in order to answer the problem correctly! The first thing we should do is to convert the given unit of measure into the desired unit which is from yard to inch. That means we will have to convert [latex]1[/latex] yard into inches. We know that [latex]1[/latex] yard equals [latex]3[/latex] feet but [latex]1[/latex] foot equals [latex]12[/latex] inches. Now, let's convert 1 yard into inches: [latex]1\,yd\,\, \times \,\,{\Large{{{3\,\,ft} \over {1\,yd}}}}\,\, \times \,\, {\Large{{{12\,\,in.} \over {1\,ft}}}}\,\, = \boxed{\,\,36\,\,in.}[/latex] Therefore, [latex]1[/latex] yard is equal to [latex]36[/latex] inches. Upon knowing the side length of the square in terms of inches, we are ready to compute for the area of the square using the formula. Since the side is [latex]36[/latex] inches, we have [latex]A = {s^2} = {\left({36} \right)^2} = 1,296[/latex] [latex]\,[/latex][latex]in^2[/latex] Therefore, the area of the square is [latex]1,296[/latex] square inches or [latex]\text{in}^2[/latex] Examples of Finding the Area of Square using its Diagonal In previous examples, we calculate the area of square using its side [latex]s[/latex]. Is there any other way to find its area other than its side? Well, there is! The fact is, it is possible to solve for the area of square if we know its diagonal. But before I simply give the formula, it is much better if I derive it for you so you can get a better appreciation why it works. Starting off, let's derive the formula for calculating a square's area given its diagonal [latex]d[/latex]. Here we have a square where the sides are labeled as [latex]s[/latex] and the diagonal is labeled as [latex]d[/latex]. Notice that the two sides of the square and its diagonal form a right triangle (a triangle that contains a 90-degree angle). It implies we can mathematically relate the diagonal and the sides of the right triangle in an equation using the Pythagorean Theorem. The square of the length of the hypotenuse [latex]c[/latex], which is the side opposite the right angle, is equal to the sum of the squares of the lengths of the other two sides which are the legs namely [latex]a[/latex] and [latex]b[/latex]. In our right triangle, the legs have the same side length which is designated by [latex]s[/latex]. In addition, the hypotenuse (the side opposite the 90-degree angle or the longest side) is represented by the letter [latex]d[/latex] to mean diagonal. Substitute both [latex]a[/latex] and [latex]b[/latex] by [latex]s[/latex], and [latex]c[/latex] by [latex]d[/latex]. Notice below that we combined [latex]s^2[/latex] and [latex]s^2[/latex] to get [latex]2s^2[/latex]. To solve for [latex]s^2[/latex], we divide both sides of the equation by [latex]2[/latex]. Notice, I didn't completely solve for [latex]s[/latex] by taking the square root of both sides. I intentionally kept [latex]s^2[/latex] because that is actually what we want since the area of the square is side times side or simply side squared, [latex]s^2[/latex]. Therefore, an alternative formula to find the area of the square is [latex]A = {\Large{{{d^2}} \over 2}}[/latex] where [latex]d[/latex] is the diagonal of the square Example 5: What is the area of a square whose diagonal is [latex]8[/latex] [latex]\text{ft}[/latex]? The good thing is that we have already done the hard work above! We have derived the formula to find the area of a square when the diagonal of the square is given to us. Since the diagonal is [latex]8[/latex] [latex]\text{ft}[/latex] as you can see in the illustration below, we should be able to find the area of the square by simply substituting the value of the diagonal into the formula and then simplify. The square of [latex]8[/latex] is [latex]64[/latex]. Then we divide it by [latex]2[/latex] to get [latex]32[/latex]. \begin{align*} A &= {{{d^2}} \over 2} \\ \\ &= {{{{\left({\color{red}8} \right)}^2}} \over 2} \\ \\ &= {{64} \over 2} \\ \\ A &= 32 \end{align*} Therefore, the area of the square is [latex]32[/latex] [latex]\text{ft}^2[/latex]. The formula above can also be used to calculate the diagonal of a square if we know its area. Let's look at an example. Example 6: If the area of a square is [latex]72[/latex] [latex]\text{cm}^2[/latex], what is the length of the diagonal of the square? Let's begin by the writing the formula of the area of the square when the diagonal is given. [latex]\boxed{A = {{{d^2}} \over 2}}[/latex] Since we know the area of the square, let's replace [latex]A[/latex] by [latex]72[/latex] on the left side of the equation. To keep [latex]d^2[/latex] to the right side of the equation, we will multiply [latex]2[/latex] on both sides of the equation. Finally, to isolate the variable [latex]d[/latex] on the right side we will take the square roots of both sides. \begin{align*} A &= {{{d^2}} \over 2} \\ \\ 72 &= {{{d^2}} \over 2} \\ \\ \left(72 \right)2 &= {d^2} \\ \\ 144 &= {d^2} \\ \\ \sqrt {144} &= \sqrt {d^2} \\ \\ \color{red}12 &= d \end{align*} Therefore, the diagonal of the square is [latex]12[/latex] [latex]\text{cm}[/latex]. Examples of Finding the Area of Square using its Perimeter Now there is a case when we are given the perimeter of the square and we are asked to find its area. How do we do that? Let's begin by recalling that the square's perimeter is merely the sum of all its sides. Since a square is a quadrilateral, it has four (4) sides, so to calculate its perimeter, we must add all four sides together. Moreover, the sides of a square are of equal length. If we let one side to be [latex]s[/latex] then the sum of all four sides must be [latex]s+s+s+s=4s[/latex]. Therefore, the formula for the perimeter of a square is [latex]\boxed{P = s + s + s + s = 4s}[/latex] Having learned how to find the square's perimeter if we know its side, it should be possible to use the same formula to determine the side of the square if the perimeter is given to us. Looking at the formula again where the perimeter of square is four times its side, [latex]4s[/latex]. The variable [latex]s[/latex] [which is the side of the square] can be solved or isolated by dividing both sides of equation by [latex]4[/latex]. [latex]\boxed{P = 4s}[/latex] If we divide the entire equation by [latex]4[/latex], we get: \begin{align*} P &= 4s \\ \\ {P \over 4} &= {{\cancel{4}s} \over \cancel{4}} \\ \\ {P \over 4} &= s \end{align*} Simply put, dividing the perimeter by [latex]4[/latex] will yield the side length of the square. That's it! Once we know the measure of one side of the square (note: we only need one since all sides are congruent), we can go back to the basic method for calculating the area of a square, which is side times side [latex]\text{side}[/latex][latex]\times[/latex][latex]\text{side}[/latex] or side squared, [latex]\text{side}^2[/latex]. [latex]\text{Area of Square}\,\square\,[/latex][latex]=[/latex][latex]\,\text{side}[/latex][latex]\times[/latex][latex]\text{side}\,[/latex][latex]=[/latex][latex]\,s^2[/latex] The best way to illustrate this procedure is through an example! Example 7: Find the area of a square whose perimeter is [latex]56[/latex] meters. Let's draw a rough sketch of a square with a perimeter of [latex]56[/latex] [latex]\text{m}[/latex]. Since a perimeter is simply the sum of all sides, and a square has four (4) equal sides, the formula of the perimeter of square must be [latex]P = s + s + s + s = 4s[/latex] What we want is to calculate the side of the square given its perimeter. That can be achieved by simply dividing the perimeter by [latex]4[/latex]. \begin{align*} P &= 4s \\ \\ 56 &= 4s \\ \\ {{56} \over 4} &= {{\cancel{4}s} \over \cancel{4}} \\ \\ 14 &= s \end{align*} Upon knowing from our calculation above that the side of the square is [latex]14[/latex] meters, we can now find its area by substituting the measure of the side to the fundamental formula of the area of square which is the square of its side, [latex]s^2[/latex]. \begin{align*} \text{Area of Square} &= {s^2} \\ \\ &= {\left({\color{red}14} \right)^2} \\ \\ &= {\color{red}14} \times {\color{red}14} \\ \\ \text{Area of Square} &= 196 \end{align*} Therefore, the area of the square is [latex]196[/latex] [latex]\text{m}^2[/latex]. Example 8: What is the area of a square with perimeter [latex]12[/latex] feet? We should be able to solve this problem very easily with the technique above by simply dividing the given perimeter by [latex]4[/latex] and squaring the quotient to get the area of the square. But let's derive a much simpler formula that we can add in our math toolbox. Remember, if we know the perimeter of the square, we can divide by [latex]4[/latex] to get the measure of the side of the square. \begin{align*} P &= 4s \\ \\ {P \over 4} &= {{\cancel{4}s} \over \cancel{4}} \\ \\ {P \over 4} &= s \end{align*} That means, if we square both sides of the equation, the right side becomes [latex]s^2[/latex] which is literally the area of the square. In other words, we can also determine the area of square by squaring the perimeter and dividing it by [latex]16[/latex]. \begin{align*} {\left({{P \over 4}} \right)^2} &= {\left(s \right)^2} \\ \\ {{{P^2}} \over {16}} &= {s^2} \end{align*} Thus, a much simpler formula to find the area of a square when its perimeter is known: [latex]\boxed{A = {{{P^2}} \over {16}}}[/latex] So, if a square has perimeter of [latex]12[/latex] feet, its area must be \begin{align*} A &= {{{P^2}} \over {16}} \\ \\ &= {{{\left({12} \right)}^2} \over {16}} \\ \\ &= {{144} \over {16}} \\ \\ A &= 9 \end{align*} Therefore, the area of the square is [latex]9[/latex] [latex]\text{ft}^2[/latex]. Take a look at the video showing areas of squares on a dotty grid... I wonder what we can find out about the areas of shapes drawn on dotty grids...This video might give you some ideas. See also: Properties of Polygons Area is a measure of how much space there is inside a shape. Calculating the area of a shape or surface can be useful in everyday life – for example you may need to know how much paint to buy to cover a wall or how much grass seed you need to sow a lawn. This page covers the essentials you need to know in order to understand and calculate the areas of common shapes including squares and rectangles, triangles and circles. Calculating Area Using the Grid Method When a shape is drawn on a scaled grid you can find the area by counting the number of grid squares inside the shape. In this example there are 10 grid squares inside the rectangle. In order to find an area value using the grid method, we need to know the size that a grid square represents. This example uses centimetres, but the same method applies for any unit of length or distance. You could, for example be using inches, metres, miles, feet etc. In this example each grid square has a width of 1cm and a height of 1cm. In other words each grid square is one 'square centimetre'. Count the grid squares inside the large square to find its area.. There are 16 small squares so the area of the large square is 16 square centimetres. In mathematics we abbreviate 'square centimetres' to cm2. The 2 means 'squared'. Each grid square is 1cm2. The area of the large square is 16cm2. Counting squares on a grid to find the area works for all shapes – as long as the grid sizes are known. However, this method becomes more challenging when shapes do not fit the grid exactly or when you need to count fractions of grid squares. In this example the square does not fit exactly onto the grid. We can still calculate the area by counting grid squares. There are 25 full grid squares (shaded in blue). 10 half grid squares (shaded in yellow) – 10 half squares is the same as 5 full squares. There is also 1 quarter square (shaded in green) – (¼ or 0.25 of a whole square). Add the whole squares and fractions together: 25 + 5 + 0.25 = 30.25. The area of this square is therefore 30.25cm2 . You can also write this as 30¼cm2. Although using a grid and counting squares within a shape is a very simple way of learning the concepts of area it is less useful for finding exact areas with more complex shapes, when there may be many fractions of grid squares to add together. Area can be calculated using simple formulae, depending on the type of shape you are working with. The remainder of this page explains and gives examples of how to calculate the area of a shape without using the grid system. Areas of Simple Quadrilaterals: Squares and Rectangles and Parallelograms The simplest (and most commonly used) area calculations are for squares and rectangles. To find the area of a rectangle, multiply its height by its width. Area of a rectangle = height × width For a square you only need to find the length of one of the sides (as each side is the same length) and then multiply this by itself to find the area. This is the same as saying length2 or length squared. It is good practice to check that a shape is actually a square by measuring two sides. For example, the wall of a room may look like a square but when you measure it you find it is actually a rectangle. Often, in real life, shapes can be more complex. For example, imagine you want to find the area of a floor, so that you can order the right amount of carpet. A typical floor-plan of a room may not consist of a simple rectangle or square: In this example, and other examples like it, the trick is to split the shape into several rectangles (or squares). It doesn't matter how you split the shape - any of the three solutions will result in the same answer. Solution 1 and 2 require that you make two shapes and add their areas together to find the total area. For solution 3 you make a larger shape (A) and subtract the smaller shape (B) from it to find the area. Another common problem is to the find the area of a border – a shape within another shape. This example shows a path around a field – the path is 2m wide. Again, there are several ways to work out the area of the path in this example. You could view the path as four separate rectangles, calculate their dimensions and then their area and finally add the areas together to give a total. A faster way would be to work out the area of the whole shape and the area of the internal rectangle. Subtract the internal rectangle area from the whole leaving the area of the path. The area of the whole shape is 16m × 10m = 160m2. We can work out the dimensions of the middle section because we know the path around the edge is 2m wide. The width of the whole shape is 16m and the width of the path across the whole shape is 4m (2m on the left of the shape and 2m on the right). 16m - 4m = 12m We can do the same for the height: 10m - 2m - 2m = 6m So we have calculated that the middle rectangle is 12m × 6m. The area of the middle rectangle is therefore: 12m × 6m = 72m2. Finally we take the area of the middle rectangle away from the area of the whole shape. 160 - 72 = 88m2. The area of the path is 88m2. A parallelogram is a four-sided shape with two pairs of sides with equal length – by definition a rectangle is a type of parallelogram. However, most people tend to think of parallelograms as four-sided shapes with angled lines, as illustrated here. The area of a parallelogram is calculated in the same way as for a rectangle (height × width) but it is important to understand that height does not mean the length of the vertical (or off vertical) sides but the distance between the sides. From the diagram you can see that the height is the distance between the top and bottom sides of the shape - not the length of the side. Think of an imaginary line, at right angles, between the top and bottom sides. This is the height. Calculating the Area of Triangles It can be useful to think of a triangle as half of a square or parallelogram. Assuming you know (or can measure) the dimensions of a triangle then you can quickly work out its area by using this formula: Area of a triangle = (height × width) ÷ 2. In other words you can work out the area of a triangle in the same way as the area for a square or parallelogram, then just divide your answer by 2. The height of a triangle is measured as a right-angled line from the bottom line (base) to the 'apex' (top point) of the triangle. Here are some examples: The area of the three triangles in the diagram above is the same. Each triangle has a width and height of 3cm. The area is calculated: (height × width) ÷ 2 3 × 3 = 9 9 ÷ 2 = 4.5 The area of each triangle is 4.5cm2. In real-life situations you may be faced with a problem that requires you to find the area of a triangle, such as: You want to paint the gable end of a barn. You only want to visit the decorating store once to get the right amount of paint. You know that a litre of paint will cover 10m2 of wall. How much paint do you need to cover the gable end? You need three measurements: A - The total height to the apex of the roof. B - The height of the vertical walls. C - The width of the building. In this example the measurements are: A - 12.4m B - 6.6m C - 11.6m The next stage requires some additional calculations. Think about the building as two shapes, a rectangle and a triangle. From the measurements you have you can calculate the additional measurement needed to work out the area of the gable end. Measurement D = 12.4 – 6.6 D = 5.8m You can now work out the area of the two parts of the wall: Area of the rectangular part of the wall: 6.6 × 11.6 = 76.56m2 Area of the triangular part of the wall: (5.8 × 11.6) ÷ 2 = 33.64m2 Add these two areas together to find the total area: 76.56 + 33.64 = 110.2m2 As you know that one litre of paint covers 10m2 of wall so we can work out how many litres we need to buy: 110.2 ÷ 10 = 11.02 litres. In reality you may find that paint is only sold in 5 litre or 1 litre cans, the result is just over 11 litres. You may be tempted to round down to 11 litres but, assuming we don't water down the paint, that won't be quite enough. So you will probably round up to the next whole litre and buy two 5 litre cans and two 1 litre cans making a total of 12 litres of paint. This will allow for any wastage and leave most of a litre left over for touching up at a later date. And don't forget, if you need to apply more than one coat of paint, you must multiply the quantity of paint for one coat by the number of coats required! Areas of Circles In order to calculate the area of a circle you need to know its diameter or radius. The diameter of a circle is the length of a straight line from one side of the circle to the other that passes through the central point of the circle. The diameter is twice the length of the radius (diameter = radius × 2) The radius of a circle is the length of a straight line from the central point of the circle to its edge. The radius is half of the diameter. (radius = diameter ÷ 2) You can measure the diameter or radius at any point around the circle – the important thing is to measure using a straight line that passes through (diameter) or ends at (radius) the centre of the circle. In practice, when measuring circles it is often easier to measure the diameter, then divide by 2 to find the radius. You need the radius to work out the area of a circle, the formula is: Area of a circle = πR2. This means: π = Pi is a constant that equals 3.142. R = is the radius of the circle. R2 (radius squared) means radius × radius. Therefore a circle with a radius of 5cm has an area of: 3.142 × 5 × 5 = 78.55cm2. A circle with a diameter of 3m has an area: First, we work out the radius (3m ÷ 2 = 1.5m) Then apply the formula: πR2 3.142 × 1.5 × 1.5 = 7.0695. The area of a circle with a diameter of 3m is 7.0695m2. Final Example This example pulls on much of the content of this page for solving simple area problems. This is the Ruben M. Benjamin House in Bloomington Illinois, listed on The United States National Register of Historic Places (Record Number: 376599). This example involves finding the area of the front of the house, the wooden slatted part – excluding the door and windows. The measurements you need are: A – 9.7m B – 7.6m C – 8.8m D – 4.5m E – 2.3m F – 2.7m G – 1.2m H – 1.0m Notes: All measurements are approximate. There is no need to worry about the border around the house – this has not been included in the measurements. We assume all rectangular windows are the same size. The round window measurement is the diameter of the window. The measurement for the door includes the steps. What is the area of the wooden slatted part of the house? Workings and answers below: Answers to above example First, work out the area of the main shape of the house – that is the rectangle and triangle that make up the shape. The main rectangle (B × C) 7.6 × 8.8 = 66.88m2. The height of the triangle is (A – B) 9.7 – 7.6 = 2.1. The area of the triangle is therefore (2.1 × C) ÷ 2. 2.1 × 8.8 = 18.48. 18.48 ÷ 2 = 9.24m2. The combined full area of the front of the house is the sum of the areas of the rectangle and triangle: 66.88 + 9.24 = 76.12m2. Next, work out the areas of the windows and doors, so they can be subtracted from the full area. The area of the door and steps is (D × E) 4.5 × 2.3 = 10.35m2. The area of one rectangular window is (G × F) 1.2 × 2.7 = 3.24m2. There are five rectangular windows. Multiply the area of one window by 5. 3.24 × 5 = 16.2m2. (the total area of the rectangular windows). The round window has a diameter of 1m its radius is therefore 0.5m. Using πR2, work out the area of the round window: 3.142 × 0.5 × 0.5 =. 0.7855m2. Next add up the areas of the door and windows. (door area) 10.35 + (rectangle windows area) 16.2 + (round window area) 0.7855 = 27.3355 Finally, subtract the total area for the windows and doors from the full area. 76.12 – 27.3355 = 48.7845 The area of the wooden slatted front of the house, and the answer to the problem is: 48.7845m2. You may want to round the answer up to 48.8m2 or 49m2. See our page on Estimation, Approximation and Rounding. Further Reading from Skills You Need Understanding Geometry Part of The Skills You Need Guide to Numeracy This eBook covers the basics of geometry and looks at the properties of shapes, lines and solids. These concepts are built up through the book, with worked examples and opportunities for you to practise your new skills. Whether you want to brush up on your basics, or help your children with their learning, this is the book for you. Area is the amount of space occupied by a two-dimensional figure. In other words, it is the quantity that measures the number of unit squares that cover the surface of a closed figure. The standard unit of area is square units which is generally represented as square inches, square feet, etc. Let's learn how to calculate the area of different geometric shapes through examples and practice questions. What Is the Meaning of Area? The word 'area' means a vacant surface. The area of a shape is calculated with the help of its length and width. Length is unidimensional and measured in units such as feet (ft), yards (yd), inches (in), etc. However, the area of a shape is a two-dimensional quantity. Hence, it is measured in square units like square inches or (in2), square feet or (ft 2), square yard or (yd2), etc. Most of the objects or shapes have edges and corners. The length and width of these edges are considered while calculating the area of a specific shape. How to Calculate Area? Let us see how to calculate the area of a shape with the help of a grid. The area of any shape is the number of unit squares that can fit into it. The grid is made up of many squares of sides 1 unit by 1 unit. The area of each of these squares is 1 square unit. Hence, each square is known as a unit square. Look at the figure shown below. Let us find the area of the shape drawn in the grid. The area of this shape is the number of shaded unit squares. Thus, the area of the shape = 9 square units. Now, let us look at another example. When the shape does not occupy a complete unit square, we can approximate and find its value. If it occupies about 1/2 of the unit square, we can combine two such halves to form an area of 1 square unit. Observe the figure given below. Here, the area occupied by the shape = 4 full squares and 8 half squares. Together this forms an area of 8 square units. If the shaded region is less than 1/2, we can omit those parts. For regular shapes, we have certain formulas to calculate their area. Note that this is only an approximate value. Area of a Rectangle The area of a rectangle is the space occupied by it. Consider the yellow rectangle in the grid. It has occupied 6 units. In the above example, the length of the rectangle is 3 units and the width is 2 units. The area of a rectangle is obtained by multiplying its length and width which is the same as counting the unit squares. Thus, the formula for the area of a rectangle is: Area of the rectangle = length × width. In this case, it will be 2 × 3 = 6 square units. Area of a Square The area of a square is the space occupied it. Look at the colored square shown in the grid below. It occupies 25 squares. From the figure, we can observe that the length of each side of the colored square is 5 units. Therefore, the area of the square is the product of its sides which can be represented by the formula: Area of a square = side × side. So, the area of this square = 5 × 5 = 25 square units. Area of a Circle A circle is a curved shape. The area of a circle is the amount of space enclosed within the boundary of a circle. Learn more about π and radius before we go to the formula for the area of a circle. The area of a circle is calculated with the help of the formula: π r2, where π is a mathematical constant whose value is approximated to 3.14 or 22/7 and r is the radius of the circle. Area of Geometric Shapes - Formula Each shape has different dimensions and formulas. The following table shows the list of formulas for the area of various shapes. Shape Area of Shapes - Formula Square Area of a square = x2 square units Rectangle Area of a rectangle = length × width = l × w square units Circle Area of a circle = π r2 square units Triangle Area of a triangle =\(\dfrac{1}{2}\times b \times h\) square units Parallelogram Area of a parallelogram = base × height = b × h square units Isosceles Trapezoid Area of an isosceles trapezoid = \(\dfrac{1}{2}(a+b) h\) square units Rhombus Area of a rhombus = \(\dfrac{1}{2}\times (d1) \times (d2)\) square units Kite Area of a kite = \(\dfrac{1}{2}\times (d1) \times (d2)\)square units ☛ Related Topics on Area Check out the following topics related to areas of different shapes and learn more about area formulas. Geometric Area Formula Area of Triangle Tips and Tricks We often memorize the formulas for calculating the area of shapes. An easier method would be to use grid lines to understand how the formula has been derived. We often get confused between the area and perimeter of a shape. A thorough understanding can be built by tracing the surface of any shape and observing that the area is essentially the space or the region covered by the shape. Example 1: Find the area of a square with a side of 7 cm. Solution: Area of a square = side × side. Here, side = 7 cm Substituting the values, 7 × 7= 49. Therefore, the area of the square = 49 square cm. Example 2: The dimensions of a rectangle are 15 cm and 8 cm. Find its area. Solution: The area of a rectangle is the product of its length and width, which can be represented by the formula: Area = l × w. Substituting the given values, we get area of the rectangle = 15 × 8 = 120 cm2 Example 3: Can you find the area of a circle with a radius of 14 cm? Solution: The radius of the circle = 14 cm Area of a circle is calculated by the formula π r2 Substituting the values in the formula, area = \(\dfrac{22}{ 7}\) × 14 × 14 = 616 square cm. Example 4: Calculate the area of the given shape by counting the squares. Solution: Let's calculate the full squares and the half squares. There are 24 unit squares and 5 half squares. Therefore, the area of the shape = 24 + (5 × ½) = 24 + 2.5 26.5 square units Get Solution > go to slidego to slidego to slidego to slide How can your child master math concepts? Math mastery comes with practice and understanding the 'Why' behind the 'What.' Experience the Cuemath difference. Book a Free Trial Class FAQs on Area The area of a shape is a two-dimensional quantity that is measured in square units like square inches or (in2), square feet or (ft2), square yard or (yd2), etc. How do You Find the Area of Irregular Shapes? The area of irregular shapes can be found by dividing the shape into unit squares. When the shape does not occupy the complete unit square, we can approximate and find its value. How do You Prove the Area of the Circle? If a circle is folded into a triangle, the radius becomes the height of the triangle and the perimeter becomes its base which is 2 × π × r. We know that the area of the triangle is found by multiplying its base and height and then dividing by 2, which is: ½ × 2 × π × r × r. Therefore, the area of the circle is π r2. What is Perimeter and Area of Triangle? The total length of the boundary of a closed shape is called its perimeter. In other words, the perimeter is the sum of the sides of a 2-dimensional shape. The perimeter of the triangle is the sum of three sides of the triangle whereas the area of the triangle is What are the Formulas for Area and Perimeter of a Square and Rectangle? The formulas for the area and perimeter of a square and a rectangle are as follows. Area of a square = side × side. The perimeter of a square = 4 × side. Area of a rectangle = length × breadth. Perimeter of a rectangle = 2 ×(length + width) Why is Area Expressed in Square Units? The area of a shape is the number of unit squares required to completely cover it. Therefore, it is measured and expressed in square units. Q1: Find the area of a square whose side is equal to 6 units. 30 square units32 square units 34 square units36 square unitsQ2: Find the area of a triangle whose base is 36 units and height is 15 units. 540 square units500 square units250 square units270 sq unitsQ3: The height of a parallelogram is 40 units and its base is 22 units. Find its area. 800 square units400 square units440 square units880 square unitsQ4: The two bases of a trapezoid are equal to 5 and 10 respectively. If the height of the trapezoid is equal to 8 units, find its area. 90 square units120 square units30 square units60 square unitsQ5: The diagonals of a rhombus are of lengths 18 units and 21 units. Find the area of the rhombus. 169 square units289 square units378 square units189 square units