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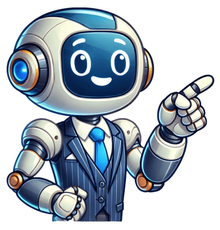

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The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. Trigonometry, the branch of mathematics that describes the relationship between the angles and lengths of triangles, helped early explorers plot the stars and navigate the seas. Nowadays, trigonometry is found in everything from architecture to zigzag scissors. While it may seem as if trigonometry is never used outside of the classroom, you may be surprised to learn just how often trigonometry and its applications are encountered in the real world. Much of architecture and engineering relies on triangular supports. When an engineer determines the length of cables, the height of support towers, and the angle between the two when gauging weight loads and bridge strength, trigonometry helps him to calculate the correct angles. It also allows builders to correctly lay out a curved wall, figure the proper slope of a roof or the correct height and rise of a stairway. You can also use trigonometry at home to determine the height of a tree on your property without the need to climb dozens of feet in the air, or find the square footage of a curved piece of land. Trigonometry plays a major role in musical theory and production. Sound waves travel in a repeating wave pattern, which can be represented graphically by sine and cosine functions. A single note can be modeled on a sine curve, and a chord can be modeled with multiple sine curves used in conjunction with one another. A graphical representation of music allows computers to create and understand sounds. It also allows sound engineers to visualize sound waves so that they can adjust volume, pitch and other elements to create the desired sound effects. Trigonometry plays an important role in speaker placement as well, since the angles of sound waves hitting the ears can influence the sound quality. Modern power companies use alternating current to send electricity over long-distance wires. In an alternating current, the electrical charge regularly reverses direction to deliver power safely and reliably to homes and businesses. Electrical engineers use trigonometry to model this flow and the change of direction, with the sine function used to model voltage. Every time you flip on a light switch or turn on the television, you're benefiting from one of trigonometry's many uses. Trigonometry plays a major role in industry, where it allows manufacturers to create everything from automobiles to zigzag scissors. Engineers rely on trigonometric relationships to determine the sizes and angles of mechanical parts used in machinery, tools and equipment. This math plays a major role in automotive engineering, allowing car companies to size each part correctly and ensure they work safely together. Trigonometry is also used by seamstresses where determining the angle of darts or length of fabric needed to craft a certain shape of skirt or shirt is accomplished using basic trigonometric relationships. Beach, Emily. "What Are Some Real-Life Applications Of Trigonometry?" sciencing.com, . 13 March 2018. APA Beach, Emily. (2018, March 13). What Are Some Real-Life Applications Of Trigonometry?. sciencing.com. Retrieved from Chicago Beach, Emily. What Are Some Real-Life Applications Of Trigonometry? last modified August 30, 2022. Trigonometric functions are mathematical functions that relate the angles of a right triangle to the ratios of its sides. There are six primary trigonometric functions, each defined based on the angles of a right triangle, such as sine, cosine, tangent, and their reciprocals, cosine, csc, and cot.One of the real-life applications is Measuring Heights and Distances of a Building without any special gadgets. For example, you are standing 100 feet away from a building. The angle of elevation to the top of the building is 40°. What is the height of the building?Measuring the height of buildingSolution: Given that, the value of θ = 40°, distance = 100 feetheight = 100 × tan(40°)height = 100 × 0.8391 = 83.91feetTrigonometric functions have a wide range of applications across various fields. Here are some key areas where trigonometry is applied:In PhysicsResolving ForcesIn mechanics, trigonometry is used to resolve a force into its horizontal and vertical components, which makes it easier to analyze the motion of objects.Example:Imagine a worker pulling a cart with a rope that is inclined at an angle above the horizontal. The rope creates a force at an angle, rather than directly forward or upward. This angled force can be resolved into two components:A horizontal component that helps move the cart forward.A vertical component that slightly lifts the cart (reducing normal force and friction).Wave MotionTrigonometric functions describe the behaviour of periodic waves, such as sound and light waves. The displacement of a wave can be represented using sine or cosine functions.Example: A sound wave can be represented by a sine wave: $y(t) = A \sin(2\pi ft + \phi)$, where A is the amplitude, f is the frequency, t is time, and ϕ is the phase shift.Oscillations: Simple harmonic motion, such as the motion of a pendulum or spring, is modelled using sine and cosine functions.Example: The displacement of a mass on a spring in simple harmonic motion is modelled as $x(t) = A \cos(\omega t + \phi)$, where A is the maximum displacement (amplitude), ω is the angular frequency, and ϕ is the phase constant.In electromagnetism, trigonometric functions are used to describe the electric and magnetic fields of travelling waves.In EngineeringSignal Processing: Trigonometric functions, particularly sine and cosine, are crucial in analyzing signals, especially in the context of Fourier analysis, which breaks down complex signals into simpler sine and cosine components.Example: A complex signal f(t) can be broken into sine and cosine waves using the Fourier Transform: $f(t) = \sum_{n=1}^{\infty} \left(a_n \cos(n\omega t) + b_n \sin(n\omega t) \right)$AC Circuits: In electrical engineering, alternating current (AC) voltages and currents are described using sinusoidal functions, helping in understanding waveforms and their properties.The voltage across a resistor in an AC circuit is given by: $V(t) = V_0\cos(\omega t + \phi)$, where V_0 is the peak voltage, ω is the angular frequency, and ϕ is the phase shift.Structural Engineering: Trigonometry helps in determining forces and moments in structures. For example, the calculation of angles and forces in trusses or beams often uses trigonometric identities.In Geography and NavigationSurveying Trigonometry is used in land surveying to calculate distances, angles, and elevations. Theodolites, which measure angles, rely on trigonometric principles to calculate horizontal and vertical positions.Example: To calculate the distance between two points in a triangle: $d = \frac{a}{\sin(\theta)} = \frac{b}{\sin(\alpha)}$ where a and b are the lengths of two sides of the triangle and θ and α are the angles.GPS and Mapping Trigonometric functions are essential in calculating distances and directions when determining locations using latitude and longitude coordinates.Example: Latitude and longitude can be converted to distances using spherical trigonometry: $d = R \cos^{-1} \left(\sin(\phi_1) \sin(\phi_2) + \cos(\phi_1) \cos(\phi_2) \cos(\lambda_2 - \lambda_1) \right)$ where R is the Earth's radius, ϕ_1 and ϕ_2 are the latitudes, and λ_1 and λ_2 are the longitudes of two points.Trigonometry helps in determining courses, distances, and positions when navigating, particularly in aviation and maritime contexts.In Computer Science and GraphicsComputer Graphics Trigonometric functions are used to simulate lighting, shadows, and rotations in 3D rendering.Example: Rotating a point (x, y) in 2D by an angle θ: $\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$Robotics In robotics, trigonometric functions help model the movements and rotations of robotic arms and other mechanical systems.Example: The position of a robotic arm joint can be modeled using trigonometric functions: $x = L_1 \cos(\theta_1) + L_2 \cos(\theta_1 + \theta_2)$ where L_1 and L_2 are the lengths of the arm segments, and θ_1 and θ_2 are the angles of the joints.In AcousticsSound WavesThe propagation of sound can be modeled using sine and cosine functions, which describe amplitude, frequency, and phase shifts.Musical TuningTrigonometric functions are used in sound frequency analysis and to describe musical intervals in terms of wavelengths and frequencies.Example: The frequency of a musical note can be related to the harmonic series: $f_n = nf_1$, where f_n is the frequency of the nth harmonic, and f_1 is the fundamental frequency.Read More, In simple terms, trigonometry is the ratio of lengths, angles, and triangles. Originating in ancient Greece, trigonometry is an amalgamation of two words, ‘trigono’ meaning triangle, and ‘metry’ meaning measure. If we remember correctly, the problems under this section in our Math books included situations like a shadow of a lamppost falling on the road, tying a rope to a pole, measuring the height of a building, etc.So, can we use it in our daily life also? Yes, we can and we do also. This is what we will talk about today- how do we use trigonometry in real life? Trigonometry uses in real life1. In playing video gamesWhile designing video games, the developers use trigonometry in various aspects. In every game, there are objects that move. The speed and positions of these objects are written using x and y. To find the value of x and y, triangles are formed using the radius and number of degrees the object will move. Using the ‘x’ and ‘y’ values, the objects can rotate in the game also. The popular video game Mario is a fine example. 2. NASA uses it too!Yes, they use trigonometry to calculate how far a planet or a star is from Earth. For example, to calculate the distance between the Earth and the moon, the circumference of the moon and one of the diameters are used to calculate the arc-length formula. Putting the values, the exact distance in the Miles unit comes out. Neil Armstrong and Edwin Aldrin successfully etched their name in history by landing on the moon only because trigonometry helped in all the calculations. 3. In measuring heightsEveryone knows that Everest has a height of 8848 meters. Indeed, nobody actually climbed Everest with a measuring tape and recorded its height. It is only a trick of trigonometry where a point of observation is located first. Next, you measure the object’s distance from the observation point and the angle between an imaginary line from the top of the object and the observation point. Calculating them with the tan function will give you the height.4. Developing sound effectsImagine you are watching a horror movie. When a spirit suddenly appears on the screen, you jump because of the scene and the eerie sound. Also, when you scroll through YouTube, you will find posts like “music for deep concentration, the study” or something like that. How do you think sound engineers develop these sound effects with the perfect pitch, volume, and other things? Yes, you got it right. They study the sound waves created by sine and cosine curves, analyze and comprehend the music and make necessary changes.READ : 11 helpful apps for your learning disability5. Building a house? Trigonometry is there to save you!The construction industry uses trigonometry widely. From measuring how much the roof will be inclined to planning and constructing parallel/perpendicular walls- architects or designers need to calculate all in trigonometry. They use the tan function to decide how long a wall should be. The Sine function helps them measure how far up a wall is. With the exact intersection angles available, architects plan accordingly to ensure the safety of the building. 6. Flying somewhere? Don’t forget trigonometry!Once an airplane is up in the sky, it is not the engine or the pilot’s skill that keeps it floating. The direction and pressure of wind are also integral to ensuring the safety of the bird. If we take a right-angled triangle and consider the two perpendicular sides, we can get the direction the wind is blowing in. Air Traffic Control uses the speed and angle of flying of the airplane and the speed of the wind. On paper, these data will produce a triangle and calculate the third side using trigonometric ratios. This way, the control tower guides the pilots on which way to use so that the wind direction can facilitate the plane’s journey. 7. Do you hope to be an archaeologist someday? You will need trigonometry!When you see an excavation site, you will see that the area is not dug up randomly. The archeologists divide the area into equal parts. Where to dig and how deep to dig- these are calculated by trigonometry only. Archaeologists label and mark rock layers into numbered plots to identify which artifact was in which province, calculate the underground position of an artifact from above the ground using their position as the observation point and angle between the artifact and observation point surface, etc. So, to excavate successfully and add to the natural history of humankind, you will find the use of trigonometry. 8. Use trigonometry in navigationRoughly, navigation is studying any moving object. This can be in four forms: maritime, aviation, terrestrial, and space. We already told you about aviation and space. Sailors at sea use sextant tools and compasses to measure the angle of the sun with the horizon at a particular time. The third angle can be easily calculated considering the vessel as another side of a triangle. GPS, or Global Positioning System, uses triangular trigonometric techniques while orbiting over specific locations on earth. Three positions of the satellites with the earth’s location form a triangle. You can determine where exactly a moving vehicle is using the formula and ratio of trigonometry. READ : 6 Common Examples Of Reflex Angle In Our Daily Lives9. Want to explore life underwater? Use trigonometryMarine biology, or the study of plants and animals inhabiting the ocean, also uses trigonometry. A marine biologist calculates the depression or elevation angle using the water level to understand how far a particular plant or animal is. Also, you find out that there are different types of phytoplanktons or algae at different depths of the ocean. So, the sunlight reaches these algae at different angles too. The length and depth of the sunlight might impact their photosynthesis effectiveness or speed. You can find the answer by connecting the algae’s position, depth of the algae from the sea surface, and angle of sunlight.10. Manufacturing a car or a shirt- trigonometry finds its use.Engineers in the automobile industry manufacture vehicles with utmost perfection by accurately calculating trigonometric formulas to estimate the size of the items. These, in turn, ensure that when the car is ready to run on the road, its parts work in absolute coordination. When you go to the tailor and give your measurements for a dress, they tell you to extend your arm. So, your arm and your body create a right angle. Measuring the arm’s length and the length of your torso, they get two sides of a triangle. With the value of the right angle known, they can easily decide the height of the dress. So, whatever there is to manufacture from scratch, trigonometry has extended helping hands. 11. Can you find a Smooth Criminal? Trigonometry will help you!Forensic specialists or crime investigators study how the blood has spattered; if there is a gunshot hole, they analyze it to understand the angle of impact, etc. Together with this, they use navigation technology. For example, suppose there is a blood droplet a few feet away from the blood splatter. They measure the distance first. Now, they determine the angle of blood impact. The analyst uses these two measurements to form a triangular structure and, using trigonometric formula and tan function, determine the height at which blood has originated. Finally, the criminal’s position and type of weapon are deduced.12. Trigonometry is your companion in designing a marine rampWhen a marine vessel is floating toward its destination, it needs a proper marine ramp. Using trigonometry, you connect the lower and the higher level areas by forming a sloping surface. This is necessary for building a marine vessel or navigating it.READ : 10 Fun Math Activities To Include In Team Building Sessions13. Use in medical serviceMany people across the globe continue their everyday life with prosthetic body parts after any accident. Trigonometry helps medical professionals design those based on specific proportions. They measure the angle at which the prosthetic limb should be set to provide stability. Next, they measure the prosthetic limb’s angles while swinging in the air and touching the ground. With these three angles known, they calculate the length and other data of the limb and prepare it accordingly so that it fits perfectly. The suspension system they use for controlled coordination of the amputee’s limbs measures the body as one side of the triangle forming a right angle with the system.14. Other uses of trigonometry in real lifeCalculating projectile motion, vector components, field strengths, etc. in PhysicsCreating maps or cartographyCalculating heights of ocean tides in oceanographyIn-depth analysis of sound and light waves through sine and cosine functionsSatellite design and launchHow can budding learners learn trigonometry?A few exciting and fun ways to learn trigonometry can be:Play a game of building an imaginary tree house. Now try to calculate how tall the tree trunk is.Use rhymes with a mathematical twist. For example, use “the mouse ran up the clock” to plot a height graph about how high the mouse will climb every time the clock strikes.Use a paper cylinder with an ink blot point. Roll it on a sheet of paper. Now use it as an example of a unit circle. TakeawaySo, trigonometry has a lot to do in real life apart from only calculating heights, right? Knowing trigonometry deeply means knowing how to solve many a problem. Once you know the formulas and functions by heart, it is nothing to be afraid of. As you can see, trigonometry can be of help in a variety of professions also. So whatever you aspire to be, a mathematician or a seamstress, trigonometry will always accompany you in your career and profession.An engineer, Maths expert, Online Tutor and animal rights activist. In more than 5+ years of my online teaching experience, I closely worked with many students struggling with dyscalculia and dyslexia. With the years passing, I learned that not much effort being put into the awareness of this learning disorder. Students with dyscalculia often misunderstood for having just a simple math fear. This is still an underresearched and understudied subject. I am also the founder of Smartynote -‘The notepad app for dyslexia’, Applications of Trigonometry can be found in different fields in our day-to-day lives. One of the well-known fields is astronomy where trigonometry helps in determining the distances of the Earth from the planets and stars. It is used in constructing maps in geography and navigation. Applications of trigonometry are also used in finding an island's position in relation to the longitudes and latitudes. Even today, some of the technologically advanced methods which are used in engineering and physical sciences are based on the concepts of trigonometry. Let us learn more about the applications of trigonometry and see a few examples related to it. What is the Applications of Trigonometry? Applications of trigonometry are applied in areas such as architecture, celestial mechanics, surveying, etc. The most common fields are astronomy and physics where it helps in finding the distance between the stars and planets, the path in motion, and analysing the waves. Some of the applications include: Various fields like oceanography, seismology, meteorology, physical sciences, astronomy, acoustics, navigation, electronics, and many more. It is also helpful to find the distance of long rivers, measure the height of the mountain, etc. Spherical trigonometry has been used for locating solar, lunar, and stellar positions. What is Trigonometry? Trigonometry is considered one of the most significant branches of mathematics. The word trigonometry is formed by combining the words 'Trigonon' and 'Metron' which means triangle and measure respectively. Trigonometry is the study of the relation between the sides and angles of a right-angled triangle. It thus helps in finding the measure of unknown dimensions of a right-angled triangle using formulas and identities based on this relationship. There are three basic functions in trigonometry - sine, cosine, and tangent. Real-Life Applications of Trigonometry As we have already discovered, the applications of trigonometry are seen in different fields in real life. Let us look at all these fields briefly to understand the application of trigonometry better. Trigonometry in Astronomy Astronomy is one of the most popular fields that use trigonometry as one of the essential applications for the basic functioning of the field. Trigonometric tables were created over decades ago for computations in this field. It helps in determining the distance between the stars and planets. The tables help in locating the position of a sphere and this kind of trigonometry is called spherical trigonometry. This type of trigonometry is called linear algebra and is taught to children at a young age. Trigonometry in Flight Engineers There has been significant growth in aviation or flight engineers in terms of functionality because of trigonometry. It helps in determining the speed, direction, and distance of an airplane along with keeping in mind the speed and direction of the wind. The wind plays an important role while landing and taking off to calculate at what angle and what speed is the best for that airplane. Trigonometry in Navigation Another use of trigonometry is seen in navigating directions with the help of a compass that provides the straight direction to a destination. Here, trigonometry functions come into play that makes it simple to find the location and also find the distance. The satellite navigation system also uses trigonometric functions such as the law of cosine to calculate simple equations to help in locating the satellites in the earth's orbit 24 hours. Trigonometry in Measuring Heights Calculating the height of a mountain or a tall building can be easily found by trigonometry. The height can be determined by measuring the horizontal distance from the base and finding the angle of elevation to the top. This formation will represent a right-angle triangle with three sides, perpendicular, base, and hypotenuse. These three aspects are the necessities of calculating any trigonometric equations. Let us look at an example to understand the measurement of height. A boy is standing near a tree. He looks up at the tree and wonders "How tall is the tree?" The height of the tree can be found without actually measuring it. What we have here is a right-angled triangle, i.e., a triangle with one of the angles equal to 90 degrees. Trigonometric formulas can be applied to calculate the height of the tree, if the distance between the tree and boy, and the angle formed when the tree is viewed from the ground is given. It is determined using the tangent function, such as tan of angle is equal to the ratio of the height of the tree and the distance. Let us say the angle is θ, then tan θ = Height/Distance between object & tree Distance = Height/tan θ Let us assume that distance is 30m and the angle formed is 45 degrees, then Height = 30/tan 45° Since, tan 45° = 1 So, Height = 30 m The height of the tree can be found out by using basic trigonometry formulas. Trigonometry in Construction Trigonometry is used in construction sites in measuring ground surfaces and fields. When constructing a building, aspects like roof inclination, rook slopes, perpendicular and parallel walls, light angles, sun shading, etc, require trigonometry. It also helps while installing ceramic tiles and stones while construction. Other Uses of Trigonometry Other fields where trigonometry is used are: Criminology or crime scenes require the assistance of trigonometry in determining the estimated cause of a collision in a car accident or at what angle was a gun shot. Marine biologists use trigonometry to measure the depth of sunlight that affects algae to photosynthesis. Trigonometric functions help in describing sound and light waves. Trigonometry is used in oceanography to calculate the heights of waves and tides in oceans. Calculus is based on trigonometry and algebra. Trigonometric Ratios There are basic six ratios in trigonometry that help in establishing a relationship between the ratio of sides of a right triangle with the angle. If θ is the angle in a right-angled triangle, formed between the base and hypotenuse, then sin θ = Perpendicular/Hypotenuse cos θ = Base/Hypotenuse tan θ = Perpendicular/Base The value of the other three functions: cot, sec, and cosec depend on tan, cos, and sin respectively as given below. cot θ = 1/tan θ = Base/Perpendicualr sec θ = 1/cos θ = Hypotenuse/Base cosec θ = 1/sin θ = Hypotenuse/Perpendicular Related Topics Listed below are a few topics related to the applications of trigonometry, take a look. Example 1: A man standing at a certain distance from a building, observes the angle of elevation of its top to be 60°. He walks 30 yds away from the building. Now, the angle of elevation of the building’s top is 30°. How high is the building? Solution: Let the height of the building be h, and d be the original distance between the man and the building. The following figure depicts the given situation: We have: \[\begin{align} \tan {60^\circ } &= \sqrt 3 \hfill \\ \Rightarrow \frac{h}{d} &= \sqrt 3 \hfill \\ \Rightarrow d &= \frac{h}{{\sqrt 3 }} \hfill \\ \end{align} \] Also, \[\begin{align} \tan {30^\circ } &= \frac{1}{{\sqrt 3 }} \hfill \\ \Rightarrow \frac{h}{{d + 30}} &= \frac{1}{{\sqrt 3 }} \hfill \\ \Rightarrow \sqrt 3 h &= d + 30 \hfill \\ \Rightarrow \sqrt 3 h &= \frac{h}{{\sqrt 3 }} + 30 \hfill \\ \Rightarrow h\left({\sqrt 3 - \frac{1}{{\sqrt 3 }}} \right) &= 30 \hfill \\ \end{align} \] \[\Rightarrow h = 15\sqrt 3 yd \approx 26\;yd\] Therefore, the height of the building is about 26 yards. Example 2: A man observed a pole of height 60 ft. According to his measurement, the pole cast a 20 ft long shadow. Find the angle of elevation of the sun from the tip of the shadow using trigonometry. Solution: Let x be the angle of elevation of the sun, then tan x = 60/20 = 3 x = tan-1(3) or x = 71.56 degrees Therefore, The angle of elevation of the sun is 71.56º. View Answer > go to slidego to slide Have questions on basic mathematical concepts? Become a problem-solving champ using logic, not rules. Learn the why behind math with our certified experts Book a Free Trial Class FAQs on Applications on Trigonometry The applications of trigonometry are seen in different fields in our day-to-day life. Some of the fields are: Construction Astronomy Aviation or field engineering Navigation Measuring heights of a building Criminology Marine Biology What is the Practical Applications of Trigonometric Identities? Some of the practical applications of trigonometry are used in architecture while calculating the slope of roofs to build a home to drain rainwater or snow. Another practical application is measuring the height of different objects such as a mountain or a tree or a tower. How to Find Height with Angle of Elevation in Trigonometry? To find the height with the angle of elevation, we need to use the trigonometric formulas based on which two sides of the right triangle are given. What are the Basics of Trigonometry? Trigonometry basics deal with the measurement of angles and problems related to angles. There are six basic trigonometric ratios: sine, cosine, tangent, cosecant, secant and cotangent. All the important concepts covered under trigonometry are based on these trigonometric ratios or functions. What are the Six Basic Trigonometry Functions? There are 6 trigonometry functions which are: In simple terms, trigonometry is the ratio of lengths, angles, and triangles. Originating in ancient Greece, trigonometry is an amalgamation of two words, ‘trigono’ meaning triangle, and ‘metry’ meaning measure. If we remember correctly, the problems under this section in our Math books included situations like a shadow of a lamppost falling on the road, tying a rope to a pole, measuring the height of a building, etc.So, can we use it in our daily life also? Yes, we can and we do also. This is what we will talk about today- how do we use trigonometry in real life? Trigonometry uses in real life1. In playing video gamesWhile designing video games, the developers use trigonometry in various aspects. In every game, there are objects that move. The speed and positions of these objects are written using x and y. To find the value of x and y, triangles are formed using the radius and number of degrees the object will move. Using the ‘x’ and ‘y’ values, the objects can rotate in the game also. The popular video game Mario is a fine example. 2. NASA uses it too!Yes, they use trigonometry to calculate how far a planet or a star is from Earth. 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Once you know the formulas and functions by heart, it is nothing to be afraid of. As you can see, trigonometry can be of help in a variety of professions also. So whatever you aspire to be, a mathematician or a seamstress, trigonometry will always accompany you in your career and profession.An engineer, Maths expert, Online Tutor and animal rights activist. In more than 5+ years of my online teaching experience, I closely worked with many students struggling with dyscalculia and dyslexia. With the years passing, I learned that not much effort being put into the awareness of this learning disorder. Students with dyscalculia often misunderstood for having just a simple math fear. This is still an underresearched and understudied subject. I am also the founder of Smartynote -‘The notepad app for dyslexia’, In simple terms, trigonometry is the ratio of lengths, angles, and triangles. Originating in ancient Greece, trigonometry is an amalgamation of two words, ‘trigono’ meaning triangle, and ‘metry’ meaning measure. If we remember correctly, the problems under this section in our Math books included situations like a shadow of a lamppost falling on the road, tying a rope to a pole, measuring the height of a building, etc.So, can we use it in our daily life also? Yes, we can and we do also. This is what we will talk about today- how do we use trigonometry in real life? Trigonometry uses in real life1. In playing video gamesWhile designing video games, the developers use trigonometry in various aspects. In every game, there are objects that move. The speed and positions of these objects are written using x and y. To find the value of x and y, triangles are formed using the radius and number of degrees the object will move. Using the ‘x’ and ‘y’ values, the objects can rotate in the game also. The popular video game Mario is a fine example. 2. NASA uses it too!Yes, they use trigonometry to calculate how far a planet or a star is from Earth. For example, to calculate the distance between the Earth and the moon, the circumference of the moon and one of the diameters are used to calculate the arc-length formula. Putting the values, the exact distance in the Miles unit comes out. Neil Armstrong and Edwin Aldrin successfully etched their name in history by landing on the moon only because trigonometry helped in all the calculations. 3. In measuring heightsEveryone knows that Everest has a height of 8848 meters. Indeed, nobody actually climbed Everest with a measuring tape and recorded its height. It is only a trick of trigonometry where a point of observation is located first. Next, you measure the object’s distance from the observation point and the angle between an imaginary line from the top of the object and the observation point. Calculating them with the tan function will give you the height.4. Developing sound effectsImagine you are watching a horror movie. When a spirit suddenly appears on the screen, you jump because of the scene and the eerie sound. Also, when you scroll through YouTube, you will find posts like “music for deep concentration, the study” or something like that. How do you think sound engineers develop these sound effects with the perfect pitch, volume, and other things? Yes, you got it right. They study the sound waves created by sine and cosine curves, analyze and comprehend the music and make necessary changes.READ : 11 helpful apps for your learning disability5. Building a house? Trigonometry is there to save you!The construction industry uses trigonometry widely. From measuring how much the roof will be inclined to planning and constructing parallel/perpendicular walls- architects or designers need to calculate all in trigonometry. They use the tan function to decide how long a wall should be. The Sine function helps them measure how far up a wall is. With the exact intersection angles available, architects plan accordingly to ensure the safety of the building. 6. Flying somewhere? Don’t forget trigonometry!Once an airplane is up in the sky, it is not the engine or the pilot’s skill that keeps it floating. The direction and pressure of wind are also integral to ensuring the safety of the bird. If we take a right-angled triangle and consider the two perpendicular sides, we can get the direction the wind is blowing in. Air Traffic Control uses the speed and angle of flying of the airplane and the speed of the wind. On paper, these data will produce a triangle and calculate the third side using trigonometric ratios. This way, the control tower guides the pilots on which way to use so that the wind direction can facilitate the plane’s journey. 7. Do you hope to be an archaeologist someday? You will need trigonometry!When you see an excavation site, you will see that the area is not dug up randomly. The archeologists divide the area into equal parts. Where to dig and how deep to dig- these are calculated by trigonometry only. Archaeologists label and mark rock layers into numbered plots to identify which artifact was in which province, calculate the underground position of an artifact from above the ground using their position as the observation point and angle between the artifact and observation point surface, etc. So, to excavate successfully and add to the natural history of humankind, you will find the use of trigonometry. 8. Use trigonometry in navigationRoughly, navigation is studying any moving object. This can be in four forms: maritime, aviation, terrestrial, and space. We already told you about aviation and space. Sailors at sea use sextant tools and compasses to measure the angle of the sun with the horizon at a particular time. The third angle can be easily calculated considering the vessel as another side of a triangle. GPS, or Global Positioning System, uses triangular trigonometric techniques while orbiting over specific locations on earth. Three positions of the satellites with the earth’s location form a triangle. You can determine where exactly a moving vehicle is using the formula and ratio of trigonometry. READ : 6 Common Examples Of Reflex Angle In Our Daily Lives9. Want to explore life underwater? Use trigonometryMarine biology, or the study of plants and animals inhabiting the ocean, also uses trigonometry. A marine biologist calculates the depression or elevation angle using the water level to understand how far a particular plant or animal is. Also, you find out that there are different types of phytoplanktons or algae at different depths of the ocean. So, the sunlight reaches these algae at different angles too. The length and depth of the sunlight might impact their photosynthesis effectiveness or speed. 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However, this often leads students to wonder how these ideas are applied in technology and other disciplines. So, what are trig functions used for in real life? Trig functions are used or found in architecture & construction, communications, day length, electrical engineering, flight, GPS, graphics, land surveying & cartography, music, tides, optics, and trajectories. Of course, the trig function we use will depend on the situation we find ourselves in. Often, a computer will perform the calculations, but the mathematical concepts are still very much necessary for our technology to work correctly. In this article, we’ll take a closer look at 12 real life examples of how trig functions are used every day. Let’s get started (You can watch a video version of this article on YouTube). Having math trouble? Looking for a tutor? Trig functions are used in real life a lot more often than you think. Although you might not need to use trig functions in your work, they probably shows up many times throughout your day – without you even realizing it! (If it’s been a while, you can get a quick refresher on trig functions with this resource from Clark University). Here are some fields that use trigonometric functions: Architecture & Construction Communications Day Length Electrical Engineering Flight GPS Graphics Land Surveying & Cartography Music Tides Optics Trajectories Let’s start with architecture & construction. Trig functions are used for architecture and construction in many different ways. Some of the uses include: Building Height Pitch of a Roof Trusses & Supports Dartmouth College has an interesting article about how an old method to find the height of a point on a building is still used to this day. We can also use tangent to calculate the height of the roof of a building, given the width of the roof and the desired angle (or “pitch”) of the roof. If H is the height, W is the width, and A is the angle (pitch) of the roof, then we can use the equation: since tangent is opposite (height) divided by hypotenuse. We can rearrange (by multiplying W on both sides) to get: So, to find the height of the roof, we take the tangent of the angle (pitch) of the roof and then multiply by the width of the roof. So, if we wanted a pitch of 45 degrees (fairly steep!) for a roof that is 40 feet wide, we would have A = 45 degrees and W = 40 feet. We could then calculate the height of the roof using our formula: H = Wtan(A) [original formula] H = 40tan(45) [substitute H = 40 feet and W = 45 degrees] H = 40 [since tan(45) = 1] So, the height of the roof would also be 40 feet. In architecture, weight plays a huge role in how we construct building. More weight means more force is exerted, which means we need more support for a heavy roof or bridge. Architects can use trig functions to find the horizontal (x) and vertical (y) force components to figure out how to build a truss to support a bridge. Proper calculation of force components (using trig!) prevents the bridge from collapsing under its own weight, leaning to one side, or buckling due to imbalanced forces. Trig functions are also used in communications, such as radio waves and other signals. A radio wave can be described as sinusoidal, since it repeats periodically (just like a sine function) and has the same pattern over time. We can use sine functions to model radio waves. A sinusoidal function f(x) = Asin(Bx) can describe a radio wave. The amplitude, A, tells us how “tall” the wave is. A larger amplitude means a taller wave. This is the same A as in AM radio (amplitude modulation). When you change the amplitude, you change the shape of the wave and the signal that is sent and received. The period, 2*pi / B, tells us how long it takes the wave to go through one full “cycle”. When you change the amplitude, you change the shape of the wave and the signal. The frequency, F = 1 / period or F = B / 2*pi, tells us how often the wave repeats. A higher frequency means a faster moving wave. This is the same F as in FM radio (frequency modulation). When you change the frequency, you change the speed of the wave and the signal that is sent and received. For example, the sine function f(x) = 2sin(4x) has twice the amplitude and 4 times higher frequency than g(x) = sin(x). The day length (from sunrise to sunset) varies throughout the year, changing by a small amount each day. In fact, the amount that day length increases or decreases is not the same every day! Day length (time from sunrise to sunset) varies by the seasons. We can model the day length with a sine function. The reason is that we can model day length with a sinusoidal function. This means that day length has a maximum and a minimum, and it increases or decreases at different rates during the year. For example, near Boston, Massachusetts, the day length changes very little each day near the longest and shortest days of the year: we only gain or lose about 1 minute per day around June 21 and December 21. On the other hand, day length changes a lot each day near the “midpoints” between the shortest and longest days: we gain or lose about 3 minutes per day around March 21 and September 21. Of course, the change in day length also varies depending on latitude (how far north or south you are from the equator). Trig functions also appear in electrical engineering. For example, the Impedance Triangle relates the Resistance (R), Reactance (X), and Impedance (Z) of a circuit. We can use a trig function to find the angle between R and X, depending on which values R, X, and Z we know. Trig functions are useful in flight to determine the course a plane should take to arrive at its destination. Of course, the following factors must all be taken into account: plane’s propulsion plane’s weight (which changes during the flight as fuel is burned!) wind speed wind direction We would need to use vectors and trig functions to determine the angle a plane should fly at to maintain course. However, this will happen more than once during a flight. Trig functions are used to make course corrections to help keep an airplane on the right path. In fact, small course corrections are made throughout a flight. The reason is that the wind can change often, especially during a long flight over a great distance. GPS (global positioning system) uses trigonometry as part of a triangulation to find the position of an object on Earth (triangulation involves the Law of Sines). GPS uses trig (in triangulation) to find out where you are and helps you get to where you are going. A GPS can calculate distance base on how long it takes for a signal to travel back to it (the signal travels at the speed of light, and distance equals speed times time). Having math trouble? Looking for a tutor? Trig functions are also used often in computer graphics to determine the position of an object based on its speed (and its speed based on its acceleration). This is useful in video games, movies, and other applications. As in architecture, trig functions are used to break up a vector (velocity or acceleration) into its components (x and y directions, or possibly even z directions in 3D applications). Trig functions help to figure out where an object is going to appear on the screen, based on its current position, velocity, and acceleration. For example, let’s say an object on-screen is traveling at a speed of 50 miles per hour and moving northeast at 30 degrees from the horizontal. Then the speed components are: Horizontal Speed: +50cos(30), or about 43.3 miles per hour east. Vertical Speed: +50sin(30), or 25 miles per hour north. We can use these units to move the object the proper distance north and east on the screen using pixels (the smallest unit in a graphics system, which indicates screen size). Trigonometry also appears in land surveying and cartography (map making). For example, let’s say we want to find the distance across a river at a certain point. Trig functions can be used to find distances for map making. First, we mark our starting position. Next, we identify a stationary object across the river. Then, we mark a line between our starting position and the stationary object across the river. The next step is to move a known distance along a line perpendicular to the line across the river. Finally, we find the angle between the marker at the starting position and the stationary object across the river. Since we moved a known distance along a perpendicular line, we have a right triangle. We also know one of the side lengths (the distance we moved) and one of the angles. We can then use a trig function (tangent) to find the length of the other leg of the triangle (the distance across the river). The equation would be: rearranging, we get: where x is the angle between the starting position and the stationary object, D is the distance across the river, and K is the known distance we walked from the starting point. Trig functions are also involved in music, although not in an obvious way. We can model a sound with a sine wave: The frequency corresponds to the pitch (high frequency = high note) The volume (loudness) corresponds to the amplitude of pressure (high pressure = high volume) When you hear (or play) music, you have something that can be expressed as the sum of these various sine waves (this result is due to Joseph Fourier). We can express a sound wave as a sum of various sine waves. You can learn a lot more about how math and music are related in this article by Mark Petersen from the Colorado State University. Similar to day length, we can also model tides using trig functions. Tides vary between low tide and high tide about every 6 hours (this means that the period is about 12 hours). At low tide, you can see how much higher the water can get! The tide (which can be high, low, or somewhere in between) varies throughout the day, changing by a small amount each minute. In fact, the amount that the tide increases or decreases is not the same every minute! The reason is that we can model tide with a sinusoidal function. This means that the tide has a maximum and a minimum, and it increases or decreases at different rates during the day. For example, near Boston, Massachusetts, the tide on July 6, 2021 changes very little each day near the high tides (9:41AM and 9:49PM) and low tides (3:28AM and 3:32PM). On the other hand, the tide changes a lot each day near the “midpoints” between the low tide and high tide: the tide changes the most at the 3 hour mark between low and high tide, or around 12:40PM, 6:40PM, 12:40AM, and 6:40AM). A tide graph show a picture that looks like a sinusoidal function. Of course, the change in tide also varies depending on location (how far north or south you are from the equator). Trig functions can help us in the field of optics. For example, we can figure out how light travels via reflection and refraction. In particular, the law of refraction involves the sine function. Of course, the material that the light is traveling through will affect how fast it travels (known as the material’s refractive index). Trig functions are used all the time in any discipline that requires us to analyze trajectories, including: Ballistics (useful for crime scene investigation or firearms manufacturers) Weapons (useful for calculating trajectories, speed, acceleration, and angles necessary to intercept another object, as in missile defense systems). As with so many other disciplines, trig functions are used to break down a trajectory into components (x and y, and possibly a z component). Trig functions are used to calculate trajectories in missile defense systems. Now you know all about how trig functions are used in real life. The applications are astounding in their scope, and they make our lives much better and more enjoyable, don’t you think? Check out my article on trig functions and how to figure out their signs, based on the quadrant. You can learn about inverse trigonometric functions here. You might also want to read my article on the four quadrants and what they mean. You can learn more about the Law of Cosines (and how it helps you to solve a triangle) here. You can learn more about trig functions (and the four quadrants) in this resource from Lamar University. I hope you found this article helpful. If so, please share it with someone who can use the information. Don’t forget to subscribe to my YouTube channel & get updates on new math videos! ~Jonathon