# Speed velocity and acceleration graphs pdf

This general graph reflects the movement of the body traveling at a constant speed. The graph is linear (this is a straight line). Remember that linear equations have a common form y = mx (where m is a constant, and x is a variable). The number m is called the line slope (vertical take-off during horizontal driving). In the above diagram, we have a function: offset = speed × time or s = v × t The speed is constant, and the time is the variable. NOTE: We use the variable s offset. Be careful not to confuse with speed! Please note that the graph goes through (0.0) and slope v. The slope of the line tells us speed. We can also write speed using delta tei, v=(Deltas)/(Deltat), which means a change in displacement during time change. If we have high speed, the schedule has a steep slope. If we have a low speed the graph has a shallow slope (assuming that the vertical and horizontal scale of each chart is the same). Example 2 A marathon runner runs a constant '12' km/h. Express your offset traveled as a function of time. B. Schedule 0 ≤ t ≤ 4\h Answer a. s = 12t, offset s and time t.b. Graph s = 12t. We stop the schedule (4, 48). Example 3 Shift time schedules This is a schedule of travel by sports car: a. What is the speed for each stage of the journey? B. What is the average (average) speed for the whole trip? Answer a. The following table describes the stages of the journey. From 12:30 to 12:30 to '50' km to '30' minutes, so '100' km/h 12:30 to 13:00 Stopped 13:00-14:00 Traveled '50' km in '60' minutes, so 50 km/h between 14:00 and 14.30 stopped from 14:30 to 15:00 and drove '100' km back to the starting point for 30 minutes, so '-200' km/h b. Although the entire journey was 200\ km (100\ km, and 100\ km back) in '3' hours, the travel offset (distance from the starting point) is 0\ km. So the average speed is 0\ km/h. On the other hand, the average speed was distance/time= 200/3 = 66,7\ km/h. In summary, ave speed = offset/time'ave speed = distance / time 4 example Magnetic field particles move as follows: Find the speed of each part of the motion. Answer t = 0 to 2: v = (Deltas)/(Deltat)=4/2=2\ text(ms)^-1 (particle moves from origin at constant speed 2\text(ms)^-1.') 't = 2' to '7': 'v = (Deltas)/(Deltat)=0/5=0\ text(ms)^-1' (particle stops for 5 seconds.) t = 7 to 8: v = (Deltas)/(Deltat)=(-4)/2=-4\ text(ms)^-1 (at the last stage is negative, because the particle goes in the opposite direction back to origin.) Speed, speed and acceleration Speed and distance graphs The rate is measured in metres per second (m/s) or in kilometres per hour (km/h). If the athlete is running at a speed of 5 m /s, it will cover 5 meters in one second and 10 meters in two seconds. 2007 with a faster speed of 8m/s will travel further, 8m per second, and it will take less time to complete your journey. This video shows a working example of speed calculation and talks about constant speed. Direction of travel There are two ways to look at the trip: You can say that the travel distance can only increase or stay the same, and then the speed is always a positive number. You can consider the direction of travel, so that if you are traveling to school, this is a positive distance and traveling in the opposite direction, which is a negative distance. Sometimes the distance in a certain direction is called displacement. You just need to know the term offset Edexcel. Quantities the size and direction of which are called vectors. Speed is a vector, because speed is speed in a certain direction. Example : The boy walks in a positive direction and again with a constant speed of 2 m / s, so he walks with a speed of +2 m / s and then with a speed of -2m / s. Distance and time graphs In the Distance and Time chart: A horizontal line means that an object is stopped in a straight line to sloping upwards to mean that it has a constant speed. Line steepness or gradient indicates speed: steeper gradient means the higher speed at which the curved line means that the speed changes. If the direction of travel is concerned: the negative distance is in the opposite direction to the positive distance. A straight line of sloping down means that it has a constant speed and constant speed in a negative direction. From 30 to 50s the cyclist stopped. The schedule has a sharp gradient from 50 s to 70s than between 0s and 20s – the cyclist traveled at higher speeds. To calculate the speed from the graph, perform the slope of the straight section as shown in Figure 9.1. If you calculate the average speed over a shorter time interval, you will approach the instantaneous speed. This video explains how speed and speed, speed, and speed–time Speed change is called acceleration. Acceleration accelerates, slows down and direction changes. Figure 9.2 A positive slope (slope) means that the speed increases – the object accelerates. A horizontal line indicates that the object is driving at a constant speed. Negative slope (slope) means that the speed decreases – negative acceleration. A curved slope means that the acceleration changes – the object has uneven acceleration. Carefully check that the schedule is a time schedule, a time schedule or a time schedule. In actual speed and time schedules, speed has only positive values. Speed-time schedules may have a negative speed. there are devices in the cabs of lorries to check that the truck has not exceeded the speed limit and that the driver has stopped due to breaks. They draw a speed schedule before time for the truck. Graphs, acceleration and distance This video explains how to calculate acceleration Modern mathematical thesmading is a very compact way to encode ideas. Equations can easily contain information corresponding to multiple sentences. Galileo's description of the object moving with constant speed (perhaps the first application of mathematics motion) requires one definition, four axiomas, and six theorems. All these connections can now be written in one equation. When it comes to depth, nothing beats the equation. Well, almost nothing. Think back to the previous section about motion equations. You should remember that the three (or four) equations in that section are valid only for movement with continuous acceleration on a straight line. Because, as I correctly pointed out, no object has ever traveled in a straight line with constant acceleration anywhere in the universe at any time, these equations are only about correct, only once. Equations are perfect for describing idealized situations, but they are not always cut it out. Sometimes, you need a picture to show what's going on— a mathematical picture called a chart. Graphs are often the best way to convey descriptions of real-world events in compact form. Motion graphs come in several types, depending on which of the kinematic quantities (time, position, speed, acceleration) is assigned to which axis. Position time Let's start with some examples of movements graphing at a constant speed. There are three different curves on the right of the chart, each with a zero starting position. First of all, note that the graphs are straight. (Any line drawn on the chart is called a curve. Even a straight line is called the math curve.) This is expected in view of the linear nature of the equation concerned. (The independent variable of linear operation shall be increased not above the first power.) Compares the constant speed position and time equation with the classical slope and axis equation taught in the introductory algebra. Thus, the speed corresponds to the slope and the starting position to the vertical axis on the axis (usually perceived as the y-axis). Since each of these graphs has its own axis origin, each of these objects had the same original position. This schedule could represent a certain type of race where the contestants were all lined up in the starting line (although at these speeds it was supposed to be a race between turtles). If this was a race, then the contestants were already moving when the race started, because each curve is at the beginning of a zero slope. Note that the starting position of zero does not necessarily mean that the initial speed is also zero. The height of the curve says nothing about its slope. Position time slope is the speed y on the axis is the starting position when the two curves coincide, the two objects at that time have the same position Unlike previous examples, in the graph the position of the object with a constant, non-zero speed, starting from the origin of the rest. The main difference between this curve and the previous curve of the chart is that this curve is actually curved. The relationship between position and time is a quadrilateral when the acceleration is constant, so this curve is a parable. (The quadrilateral function variable is raised not above the second power.) s = s0 + v0Δt + 1 aΔt2 2 y = a + bx + cx2 As an exercise, let's calculate the acceleration of this object according to its schedule. It intercepts the origin, so its original position is zero, the example states that the initial speed is zero, and the graph indicates that the object traveled 9 m in 10 seconds. These numbers can then be entered into the equation. s = a = a = 2(9 m) = 0,18 m/s2 (10 s)2 When the position and time schedule are bent, the speed cannot be calculated from its slope. The slope is only the property of straight lines. Such an object does not have speed, because it does not have a slope. Here you highlight the words the and a in order to highlight the idea that there is no single speed in such circumstances. The speed of such an object must change. It's accelerating. Positions in time chart... straight segments mean constant speed curve segments mean acceleration of an object with constant acceleration traces of the parable part although our hypothetical object does not have a single speed, it still has an average speed and constantly collect instant speeds. The average speed of any object can be found by dividing the overall change in position (a.k.a. offset) by a change in time. This is the same as the slope of the lines that connect the first and last points of the curve, as shown in the diagram on the right. In this abstract example, the average speed of the object was... v = Δs = 9,5 m = 0,95 m/s Δt 10,0 s Instant speed is the limit of average speed when the time interval decreases to zero. v = Δs = ds Δt dt As the average speed line endpoints approach, they become a better indicator of actual speed. When the two points overlap, the line is tangent to the curve. This constraint process is depicted in the animation to the right. Positions in time chart... the average speed is the slope of the line that connects the endpoints of the instantaneous speed of the curve, the slope is the slope of the line touching the curve at any point, the slope seven tangents were added to our general position and time chart in the animation area above. Note that the slope is zero twice - once at the top of the bump 3.0 s and again at the bottom of the dent 6.5 s. (The bump is the local maximum, and the dent is the minimum of space. At the same time, such points are (e.g. extremism) The slope of the horizontal line is zero, which means that at that time the object was stationary. Since the schedule is not flat, the object was only dormant instantly until it began to move again. Although his position did not change at the time, his speed was. This is a concept that many people have difficulties with. It can be accelerated and still not be moving, but only instantly. Also note that the slope is negative in the interval between the bump at 3.0 s and dent 6.5 s. Some perceive this as the opposite of movement, but is it usually the case? Well, that's an abstract example. No text shall be attached to it. Graphs contain a lot of information, but without a title or other form description they don't matter. What does this diagram represent? Person? Machine? Lift? Rhinos? Asteroid? Dust daddy? About all we can say is that this object moves initially, slowed down to a stop, reverse direction, stopped again, and then again moving in the direction with which it began (in what direction it was). Negative slopes do not automatically mean that you drive back, walk to the left or do not fall. The choice of signs is always arbitrary. About all we can say in general is that when the slope is negative, the object travels in a negative direction. Positions in time chart... positive slope means movement in a positive direction negative slope means movement in a negative direction zero slope means rest speed state-time The most important thing to remember about speed-time schedules is that they are speed time schedules, not position time schedules. There is something about a linear chart that makes people think that they are looking at the path of an object. A common beginner's mistake is to look at the graph to the right and think that the v =9.0 m/s string corresponds to an object that is larger than other objects. Don't think so. That's not good. Do not look at these diagrams or think of them as a picture of a moving object. Instead, think of them as an object speed record. In these charts, higher means faster no further. The V = 9,0 m/s line is larger because it moves faster than others. These specific charts are horizontal. The initial speed of each object is the same as the final speed is the same as each speed between them. The speed of each of these objects is constant within this ten-second interval. For comparison, when the speed-time chart curve is straight but not horizontal, the speed changes. Three curves on the right each have a different slope. With a solid slope schedule experiencing the highest speed. This object has the greatest acceleration. Compares speed and time equations for constant acceleration with the classic slope and axis equation taught in the introductory algebra. You should see that the acceleration corresponds to the slope and the initial speed vertical axis. Since each of these graphs has its own axis of origin, each of these objects was initially dormant. The initial speed of zero does not mean that the starting position must also be zero. This diagram tells us nothing about the initial position of these objects. Because all we know, they can be on different planets. The timeline for speed ... slope is acceleration on the y axis is the initial speed when the two curves overlap, the two objects have the same speed at which time the curves of the previous chart were all straight lines. A straight line is a curve with a constant slope. Since the slope is acceleration in the speed and time schedule, each object depicted in this diagram moves at a steady acceleration. If the graphs were bent, the acceleration would not have been constant. The timeline for speed ... straight lines refer to constant acceleration curves of lines that imply non-conclusive acceleration, object with constant acceleration, traces in a straight line Since the curved line does not have a single slope, we need to decide what it means when it is requested for acceleration of the object. Those descriptions derive directly from the definitions of medium and instant acceleration. If a medium acceleration is desired, draw a line connecting the end points of the curve and calculate its slope. If instant acceleration is desired, take the limit of this slope, because the time interval shrinks to zero, that is, take the tangent slope. The timeline for speed ... the average acceleration is the slope of the line joining the end points of the curve in the speed and time chart... instant acceleration is the slope of the line tangle curve at any point a = Δv = dv Δt dt Seven tangents have been added to our overall speed timeline animation shown above. Note that the slope is zero twice - once bump the top 3.0 s and again dent the bottom 6.5 s. The slope of the horizontal line is zero, which means that at that time the object stopped accelerating. The acceleration can be zero in these two cases, but that does not mean that the object stopped. For this to happen, the curve should take over the horizontal axis. This occurred only once at the beginning of the chart. In both cases, when the acceleration was zero, the object still moves in a positive direction. You should also notice that the slope was negative from 3.0 to 6.5 s. During this time, the speed decreased. However, this is not true at all. The speed decreases when the curve returns to origin. Above the horizontal axis it would be a negative slope, but below it would be a positive slope. The only thing can be said about the negative slope in the speed-time schedule is that during such a interval the speed becomes increasingly negative (or less positive if you want). The timeline for speed ... positive slope means that the speed increases with positive negative slope means an increase in speed in a negative direction zero slope means movement with a constant speed kinematics, there are three quantities: position, speed, and acceleration. Depending on the schedule of any of these quantities, it is in principle always possible to determine the other two. Acceleration is the speed of the speed change time that can be found from the tangent slope to the curve speed-time schedule. But how can you determine the position? Let's consider some simple examples and then get a relationship. Start with a simple speed-time chart shown on the right. (For simplicity reasons, let's assume that the starting position is zero.) There are three important intervals in this diagram. During each interval, the acceleration is constant, as shown by the linear segments. When the acceleration is constant, the average speed is only the average of the starting and final values in the range. 0-4 s: This segment is a triangle. The area of the triangle is half the base, the height of which is larger. Basically, we just calculated the area of the triangular segment in this diagram. Δ = vΔtΔs = 1/2(v + v0)ΔtΔs = 1/2(8 m/s)(4 s)Δs = 16 m The cumulative distance travelled at the end of this interval is... 16 m 4-8 s: This segment has a trapezoidal shape. The trapezoidal area (or trapezoid) is the average of two bases with a height greater than the height. Basically, we just calculated the area of the trapezoid segment in this diagram. Δ = vΔtΔs = 1/2(v + v0)ΔtΔs = 1/2(10 m/s + 8 m/s)(4 s)Δs = 36 m cumulative distance at the end of this range is... 16 m + 36 m = 52 m 8-10 s: this segment is a rectangle. The area of the rectangle is only its height, the width of which is. Basically, we just calculated the area of the rectangular segment in this diagram. Δ = vΔtΔs = (10 m/s)(2 s)Δ = 20 m the cumulative distance travelled at the end of this range is... 16 m + 36 m + 20 m = 72 m I hope you now see the trend. The area of each segment is the change in the position of the entity within that interval. This is true even when the acceleration is not constant. Anyone who has taken the calculus of course should have known before they read it here (or at least when they read it they had to say, oh yes, I remember that). The first derivative of the exposure in terms of time is the speed. A function derivative is the slope of a line touching its curve at a certain point. The reverse activity of a derivative is referred to as an integral instrument. The integral of the function is the cumulative area between the curve and the horizontal axis at a certain interval. This inverse relationship between derivative (slope) and integral (area) action is so important that it is called the basic theorem calculation. This means that this is an important relationship. Learn! This is essential. You didn't see the last one. The timeline for speed ... the area under the curve is the change in the acceleration time of the position. The graph of any object traveling at a constant speed is the same. This is true regardless of the speed of the object. A plane flying at a steady 270 m/s (600 mph), sloth walking at a steady speed of 0.4 m/s (1 mph), and couch potatoes lying stationary in front of the TV for hours will all have the same acceleration-time graphs - horizontal line collinears with a horizontal axis. This is because the speed of each of these objects is constant. They're not accelerating. Their acceleration is zero. As in speed-time schedules, it is important to remember that the height above the horizontal axis does not match the position or speed, it corresponds to the acceleration. If you trip and fall on your way to school, your acceleration towards the ground is greater than you experience in all but a few high quality cars with a pedal to the metal. Acceleration and speed are different quantities. Going fast doesn't mean it's going to accelerate fast. Both quantities are independent of each other. High acceleration corresponds to a rapid change in speed, but it says nothing about the speed values itself. When the acceleration is constant, the acceleration and time curve is a horizontal line. The rate of change of course with time is often not discussed, so the slope of the curve in this chart will now be ignored. If you like to know the names of things, this quantity is called jerk. On the surface, the only information can glean from the acceleration time schedule seems to accelerate at any time. Acceleration Time Chart... slope is twitch y axis equal to the initial acceleration when the two curves overlap, the two objects have the same acceleration at the time of the object, where the constant acceleration traces of the horizontal line zero slope means the acceleration of motion with constant acceleration is a change in speed with time speed. Changing the speed and time schedule by acceleration and timeline means the calculation of the slope of the line tangential to the curve at any point. (In the calculation, it's called finding a derivative financial regulation.) The reverse process involves calculating the accumulated area under the curve. (In a calculation, it's called finding integral.) Then this number is the change in the value of the speed and time chart. Given the initial zero speed (and assuming the down is positive), the final speed a person enters the graph to the right is... Δv = aΔt Δv = (9,8 m/s2) (1,0 s) Δv = 9,8 m/s = 22 mph and the final speed of the acceleration car is... Δv = aΔt Δv = (5,0 m/s2) (6,0 s) Δv = 30 m/s = 67 mph acceleration time schedule... the area under the curve is equal to the change in speed There are more things that can be said about acceleration time schedules, but they are trivial for the most part. This is as important as the other three types, but rarely gets any attention below at bachelor level. One day I will write something about these charts called phase space charts, but not today. Today.