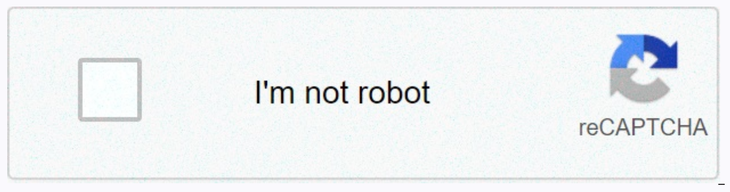

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Kinematics worksheet with solutions

The first question. The bus starts at station A from a standstill with an even acceleration of 2 m/s2. The bus is moving in a straight and. Find the distance moved by bus in 10 seconds? B. What time does the speed become 20m/s? c. How much time it will take to cover the distance of 1.6 km Solution Now the first step to trying such a question is to introduce the whole process. Here the bus moves in a straight line and with even acceleration Now what we have initial speed = 0 Acceleration = 2m / sec2 Now because there is a uniform movement, we can use a given motion pattern that is used $v = u + to $ $s = ut + \frac {1}{2}at ^ 2 $ $v ^ 2 = u ^ 2 + 2as $ a. Distance (s)= ? time(t)=10 sec So here is the best equation $s=ut+ \frac {1}{2}at^2$ Replacing given values $s=(0)10 + \frac {1}{2} 2(10)^2=100 m$ b. Speed (v) =20 m/s time (t)=? So here's the most appropriate equation is $v=u+to $20=0+2t$or t=10 sec c.distance(s)=1.6km=1600m t=? So here's the most appropriate equation is $s=ut+\frac {1}{2}at^2$1600=*{1}{2} (2) t^2$ or t=40 sec Question 2. The object moves along a straight line. The movement of this object is described $x=at+bt^2 + ct^3$, where a,b,c are constants and x is in meters and t is in sec. A. Find the displacement at t =1 s b. Find the speed at t=0 and t=1 with c. Find acceleration to t =0 and t=1 sec Solution Now the first step to trying such a question is to visualize the entire process. Zde se objekt pohybuje po přímce a jeho pohyb je popsán danou rovnicí Nyní $x=at=bt^2 + ct^3$ Nyní, protože jeho pohyb je popsán danou rovnicí, následující vzorec bude užitečný při určování hodnot $x=\int vdt$ $v=\int adt$ $v= \frac {dx}{dt}$ $a=\frac {dv}{dt}= \frac {d^2x}{dt^2}$ $a=v \frac {frac {frac{d}$a x. t=1sec Zde nahrazením t=1 v dané rovnici dostaneme odpověď $x=a(1)+b(1)^2+c(1)^3$ $x=a+b+c$ m b. v=? t=0,v=? t =1 Zde máme rovnici posunutí, takže nejprve musíme zjistit rovnici rychlosti Takže zde je nejvhodnější vzorec $v= \frac {dx}{dt}$ nebo $v=\frac {d}{dt}(at+bt^2+ct^3)$ nebo $v=a+2bt+3ct^2$ Nahrazení t=0 dostaneme $v=a$ m/s Substituting t=1 dostaneme $v=a+2b+3c$ m/s c. a=? t=0 ,a=? t=1 Now we have the speed equation, we must first find the acceleration equation. So here is the most appropriate formula $a==°frac {dv}{dt}$nebo $a==\frac {d}{dt}(a+2bt+3ct^2)$ $a =2b +6ct$ Replacing t=0 we get $a=2b$ m/s2 Replacing t=1 we get $a=2b+6c$ m/s2 Question 3. An object is invoked vertically up with an initial speed of 40m/s.Two seconds later, another object is invoked up at the same speed. Determine the following a.At what height you meet b.what is the time when you encounter c.what are the speeds of each object, when you meet the let the solution take origin in the initial position of the object and upward as a positive axis. Let's also take time t as time began when the first object was thrown Now because there is a uniform movement we can use the given motion formula is in use $v = u + to $ $s = ut + \ frac {1}{2)}at ^ 2 $ $v ^ 2 = u ^ 2 + 2as $ So from the motion equation The first object $v_1=v_0 - gt$ and $y_1= v_0t- \frac {1}{2}(gt^2)$ ---(1) Similarly for the second object. We write the equation at the same time t variable $v_2 =v_0 - g(t-2)$ and $y_2= v_0(t-2)- \frac {1}{2}g(t-2)^2$ ---(2) Now that they meet, then $y_1= y_2$ $v_0t- \frac {1}{2}(gt^2) = v_0(t-2)- \frac {1}{2}g(t-2)^2$ Solution $t= \frac {v_0}{g}+1=5.09$09 sec Substituting this value in any of the above equation will indicate the height value $H=40 \times 5.09- \frac {1}{2} (9.8 \times 5.09 \times 5.09) =2 $76.6m The appropriate speed can be found using the first set of each equation 1 and 2 For the first object $v_1=v_0 - gt =40-(9.8 \times 5.09)=-9.882$ m/sec For the second object $v_2=v_0 - g(t-2) =40-9.8(5.09-2)=9.718$ m/sec Question 4. Particles move along the x-axis according to the following equation $x=pt(1-qt)$ where p and q are constants and p > 0, q>0. Let it even as a unit vector over the x-axis and. Determine the speed and vector of partite acceleration b. What time it reaches its starting point and what the total distance of the solutions will be and. The motion equation is given by $x=pt(1-qt)$ Speed = $\frac {dx}{dt}$ So $v=p(1-2qt)$ Acceleration = $\frac {dv}{dt}$ So $a=-2pqt$ Therefore, Speed vector = $p(1-2qt) \mathbf{i}$ Acceleration Vector=$-2pqt \mathbf{i}$ b. The equation of motion is given by $x=pt(1-qt)$ per t= 0.x = 0 and $t = \frac {1}{q}$, x = 0 So when t = 1 / q , reaches the starting position of the equation of speed $v = p (1-2qt)$ From the equation we can see that for $ t < < < {1} < <3>{2q}$, $v>0$ so speed=$|v|= p(1-2qt)$ $ At $t=\frac {1}{2q}$,$v=0$ For $t > \frac {1}{2q}$,$v < 0$ so 0$ so speed=$|v|=(2qt-1)) $ Distance traveled from time t=0 to t=1/2q $s_1=\int_{0}^{\frac {1}{2q}} p(1-2qt)dt = \frac {p}{4q}$ Distance traveled from time t=1/2q to t=1/q $s_2= \int_{\frac {1}{2q}^{°frac {1}{q}} p(2qt -1)d t = \frac {p}{4q}$ So total distance traveled=$ \frac {p}{4q} + \frac {p}{4q} =\frac {p}{2q}}Question$ 5. The balloon rises from rest on the ground vertically upwards with constant acceleration g/8.The object is thrown from the balloon when it rises to a height h.Find out the time that the object takes to get to the ground. Solution Since the balloon launch is out of rest, the speed of the balloon when raised to the height of h is given by $v ^2 = u ^ 2 + 2gH $ $v ^ 2 = 2 \ times \frac {g}{8} \times h$ $v=\frac {1}{2} \sqrt {gh}$ When the object is dropped, the same speed has the same speed in the upward direction. Taking upwards as positive, $-h = \sqrt {gh} t- \frac {1}{2} gt ^2$ Where h is negative as we are as a positive axis , t is the time taken to reach the earth and acceleration is -g as gravity is active down Equation can be written in the form of $gt^2-\sqrt {gh} Solving this equation and positive root $t=2 \sqrt {\frac {h}{g}}$ Question 6. A police motorcycle is moving on a highway with a speed of v_m fires a bullet at a motorcycle thief speeding away in the same direction with a speed of $v_t (v_t > v_m)$. If the speed of the muzzle $v_b(v_b > v_t - v_m)$, find out the following and. What is the speed of the bullet when it comes to an observer sitting on the ground? B. What speed does the bullet hit the thief c. What will be the speed of the bullet with respect to another police motorcycle moving in the same direction of speed speed police motorcycle w.r.t country = $v_m $ Speed Bullet w.r.t on motorcycle or muzzle = v_b Bullet speed w.r.t ground = Bullet speed w r.t on motorcycle + motorcycle speed w.r.t on the ground So bullet speed w.r.r.t on the ground = $v_b + v_m$ Speed with bullet hit thief =Bullet speed w.r.t on the ground - Speed thief w.r t ground = $v_b + v_m- v_t$ Bullet speed w.r t next motorcycle = Bullet speed w.r.t ground - Motorcycle speed = $v_b + v_m - in$ Question 7. The nut is released from the screw on the underside of the lift as the lift moves up the shaft at a speed of 3 m/s. The nut hits the bottom of the shaft in 2 seconds Find out the following and. How far from the bottom of the shaft was the elevator when the nut fell? B. How high above the bottom of the shaft was the .25 sec nut after it fell.? c. How high above the bottom of the shaft was the lift when the nut fell to the ground? d. At what height above the bottom of the shaft does the nut have zero speed after a fall? e. What is the total distance travelled by the nut in motion after the fall? Since g = 9.8 m / s2 Solution a. Here the nut initially has the speed of the lift when it fell. Let yourself go up as a positive direction Then $v_0=3 $m/s at t=0 and $a=-g=-9.8$ m/s2 Now it's time to hit the ground t=2 So $H= v_0t+ \frac {1}{2}gt ^2$ $H=3 \times 2 + \frac {1}{2} \times (-9.8) \times 2 \times 2 =-13.6 $ m So the bottom of the shaft was 13.6 m below the level when the nut fell off the elevator. So the lift was 13.6 m above the shaft when the nut fell b. Now let the matrix shift to

t=.25 $H= v_0t+\frac {1}{2}gt^2$ Replacing the values in the same amount H=.44m Thus, the matrix was above the starting point. It makes sense if we remember the initial rate as a rise. So the total height above the bottom will be =.44+13.6=14 m c. Now the perspective of the lift in = 3m / sec So it will move 6m up in 2 sec. So the total height above ground will be = 6 + 13.6 = 19.6 m d. $v ^2 = u ^ 2 + 2ah $ In terms of nuts u = 3m / sec and = -g = -9.8m / s2 per v v = 0 $u^2=2gH$ or H=3*3/2*9.8 =.45m So the total height above the bottom of the shaft=13.6+.45=14.1 m e. Total distance travelled nut=.45+.45+13.6=14.5m Question 8. Displacement of body x (in meters) with time t (in sec) as $x =- \frac {2}{3}t^2 +16t+2$ find after a. what is the speed to t = 0.t = 1 b. What is acceleration to t = 0 c. What is displacement to t = 0 d. What will be the displacement in terms of rest e. How long does it take to calm down? Solution Due to $x=- \frac {2}{3}t^2 +16t+2$ (1) Velocity=$ \frac {dx}{dt}=\frac {-4}{3} t+16$ so speed at t=0 =16 and t=1 =1 =1 =1 =1 $fra c {-4}{3} +16=\frac {44}{3}$ Acceleration is specified as =$ \frac {d^2x}{dt^2}=- \frac {4}{3}$, so the acceleration is time-independent and there is a constant displacement at t=0 can be found simply by replacing the values of the equation t=0 in (1) So, Scroll to(t=0)=2 Now $v=- \frac {4}{3}t+$16, when v=0 then $t= \frac {4}{3}$ sec Offset can be found by replacing t=4/4/3 in equation (1) $=- \frac {32}{27} + \frac {64}{3} +2$ $= \frac {(-32+576+54)}{27}=\frac {598}{27}$ m Question 9. A man is running at 4 m/s to overtook a stationary bus. When 6 m behind the door on t = 0, the bus moves forward and continues with a constant acceleration of 1.2 m / s2 to find the following a. how long does it take for a person to get a door b. if the beginning is 10 m behind the door, will run at the same speed ever catch the bus? Solution At t=0, let the human position be $x_{m0}=0$. The bus door is then at $x_{b0}=6$ m Motion equation for men and bus $x_m=x_{m0}+v_{m0}+ \frac {1}{2}a_m t^2$ $x__b=x_{b0}+v_{b0}+\frac {1}{2}a_b t^2$ Now listed $v_{m0}=4$ m/s , $v_{b0}=0$ $$a $v 1.2 $a m/s2 so $x_m=4t$ $x_b=6+.6t^2$2 When you catch a bus $x_m=x_b $ so $ 4t = 6 +.6t ^ 2 $ or $ 3t ^ 2-20t + 30 = 0 $ Solution Quadratic Formula t = 2.3 and 4.4 s Note: here are two positive solutions . This can be explained as. The $t_1 =2.3$ s, corresponds to its first door reach. This is the real answer. However the equation we solved does not know that it stops running and get on the bus, the equations have to continue running at a constant speed. So he goes past the bus; but because the bus accelerates, it eventually builds more speed then man and will catch with it at 4.4 sec if the initial position of the bus is 10 m then $x_m = x_b $ gives $ 3t ^ 2-20t + 50 = 0 $, which has only complex roots, so no real time exits to which man catches up link to this page by copying the following textKinematics sheet Also Read Return to Class 11 Home using the links below Class 11 Mathematics Class 11 Physics Class 11 Biology Biology