Phys 101 ch2 Mr.Abdullah Mohamed @Chem31Phys

The position of an object is given as a function of time by $x = 4.0\,t^2 - 3.0\,t^3$, where x is in meters and t is in seconds. What is its average acceleration during the interval from $t = 1.0$ s to $t = 2.0$ s? (Ans: -19 m/s^2)

$x = 4t^2 - 3t^3$

$v = \frac{dx}{dt} = 8t - 9t^2$

$v_i = 8 - 9 = -1$ m/s

$v_f = 16 - 36 = -20$ m/s

$a = \frac{v_f - v_i}{t_f - t_i} = \frac{-20 - (-1)}{2 - 1} = -19$ m/s^2

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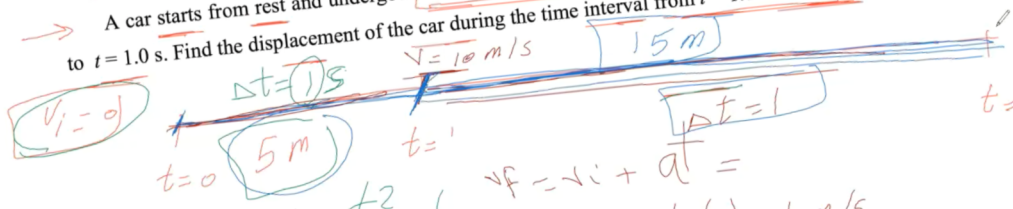
A car starts from rest and undergoes a constant acceleration. It travels 5.0 m in the time interval from $t = 0$ to $t = 1.0$ s. Find the displacement of the car during the time interval from $t = 1.0$ s to $t = 2.0$ s. (Ans: 15 m)



$\Delta x = v_i t + \frac{1}{2} a t^2$

$5 = 0 + \frac{1}{2} a (1)^2$

$5 = \frac{1}{2} a$

$a = 10$ m/s^2

$v_f = v_i + at = 0 + 10(1) = 10$ m/s

$\Delta x = v_i t + \frac{1}{2} a t^2$

$= 10(1) + \frac{1}{2}(10)(1)^2$

$= 10 + 5 = 15$ m

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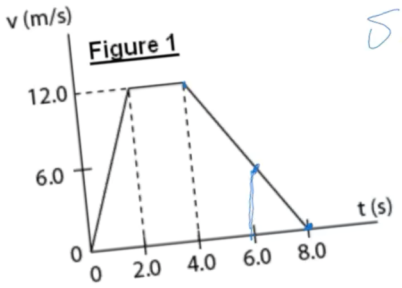
Figure 1 represents the velocity of a car moving on a straight line as a function of time.

Find the acceleration of the car at $t = 6.0$ s. (Ans: $-3.0\ m/s^2$)



$$slope = a = \frac{v_f - v_i}{t_f - t_i} = \frac{0 - 12}{8 - 4}$$

$$= \frac{-12}{+4} = -3\ m/s^2$$

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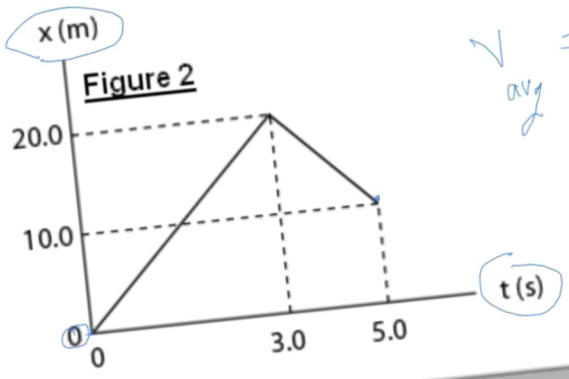
Figure 2 shows the position-time graph of an object. What is the average velocity of the object between $t = 0.0$ s and $t = 5.0$ s? (Ans: 2.0 m/s)



$$v_{avg} = \frac{x_f - x_i}{t_f - t_i} = \frac{10 - 0}{5 - 0}$$

$$= 2\ m/s$$





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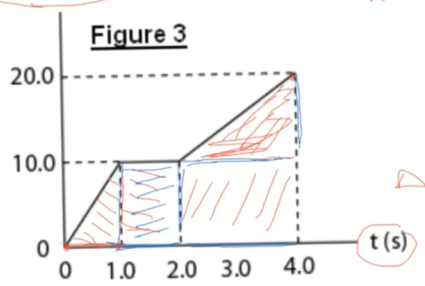
Figure 3 shows a velocity-time graph of a runner. If the runner starts from the origin, find his position at $t = 4.0$ s. (Ans: 45 m)



Δx = area under velocity – time graph

$\Delta x = \frac{1}{2}bh + lw + lw + \frac{1}{2}bh$

$= \frac{1}{2}(1)(10) + 10(1) + 10(2) + \frac{1}{2}(2)(10)$

$= 5 + 10 + 20 + 10$

$= 45\ m$

$\Delta x = x_f - x_i$

$45 = x_f - 0$

$x_f = 45m$

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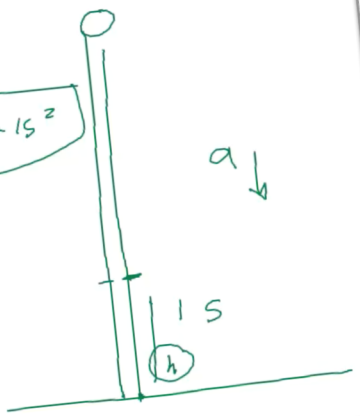
An object is thrown vertically upward with an initial speed of 25 m/s from the ground. What is the height of the object 1.0 s before it touches ground? (Ans: 20 m)

$v_i = +25\ m/s$

$a = -9.8\ m/s^2$



$\Delta y = v_i t + \frac{1}{2}at^2$

$= +25(1) + \frac{1}{2}(-9.8)(1)^2$

$= 20.1\ m$

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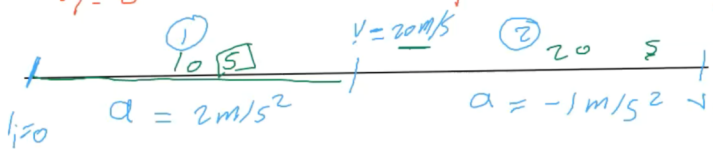
A car starts from rest and accelerates at a rate of 2.0 m/s² in a straight line until it reaches a speed of 20 m/s. The car then slows down at a constant rate of 1.0 m/s² until it stops. How much time elapses (total time) from start to stop? (Ans: 30 s)

$V_i = 0$ $a = 2 m/s^2$ $V_f = 20 m/s$ $a = -1 m/s^2$ $V_f = 0$



$i=0$ $a = 2 m/s^2$ $a = -1 m/s^2$ $V_f = 0$

$t = \frac{V_f - V_i}{a}$

$= \frac{20 - 0}{2} = 10$ s

$t = \frac{V_f - V_i}{a}$

$= \frac{0 - 20}{-1} = 20$ s

$t_{tot} = 20 + 10$

$= 30$ s

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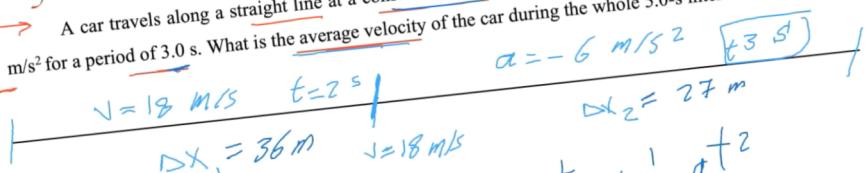
A car travels along a straight line at a constant velocity of 18 m/s for 2.0 s and then accelerates at − 6.0 m/s² for a period of 3.0 s. What is the average velocity of the car during the whole 5.0-s interval? (Ans: 13 m/s)



$\Delta x_1 = vt$

$= 18(2)$

$= 36$ m

$\Delta x = v_i t + \frac{1}{2} a t^2$

$= 18(3) + \frac{1}{2}(-6)(3)^2 = 27$ m

$x_{tot} = 36 + 27 = 63$ m

$V_{avg} = \frac{\Delta x}{\Delta t} = \frac{63}{5}$

$= 12.6$ m





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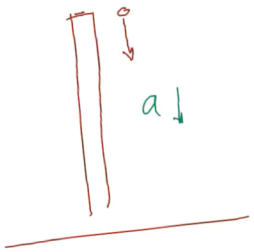
A stone is thrown vertically downward from the top of a 40-m tall building with an initial speed of 1.0 m/s.
How far will the stone travel in 2.0 s? (Ans: 22 m)

$\Delta t = 2\ s$

$\Delta y = -40\ m$

$v_i = -1\ m/s$



$$\Delta y = v_i t + \frac{1}{2} a t^2$$
$$= -1(2) + \frac{1}{2}(-9.8)(2)^2$$
$$= -21.6\ m$$

$$\Delta y = 22\ m$$

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The coordinate of a particle in meters is given by: $x(t)=2.0t - 2.0t^2$, where the time t is in seconds. At what time will the particle be momentarily at rest? (Ans: 0.50 s)

(t)

$v = 0$

$$v = \frac{dx}{dt} = 2 - 4t = 0$$

$$\frac{2}{2} = \frac{4t}{2}$$

$$2t = 1$$

$$t = 0.5\ s$$





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