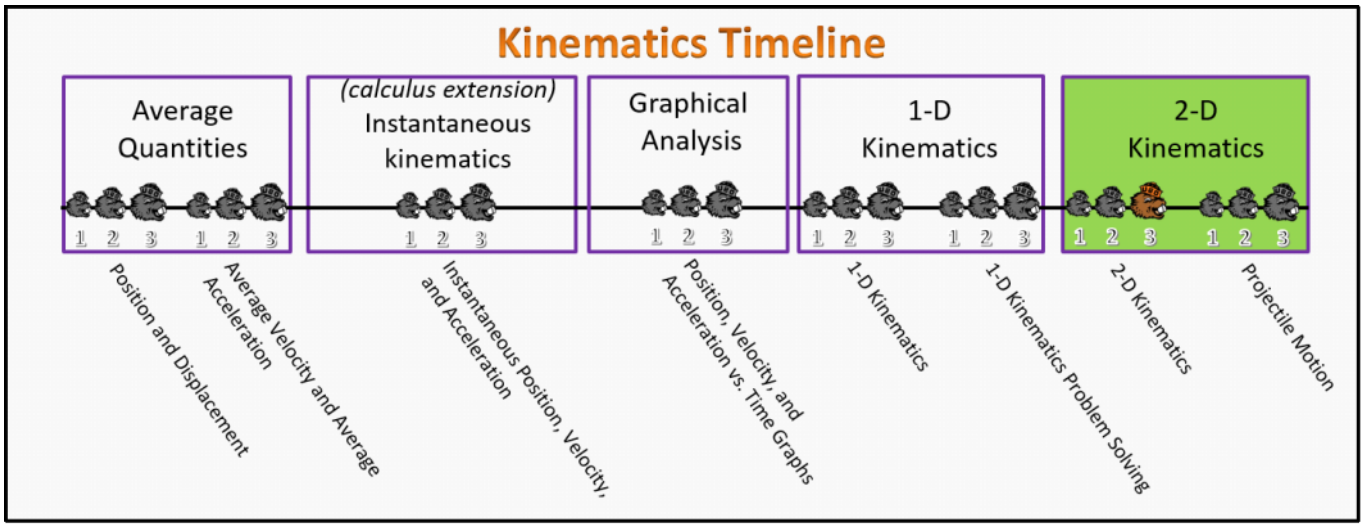
(K2.L1.3-sols) Practice Stage Solutions

Thursday, March 29, 2018 8:34 PM

2-D Kinematics
Foundation Stage (K2.L1.3)

Post-Lecture 1
2-D Kinematics



Questions

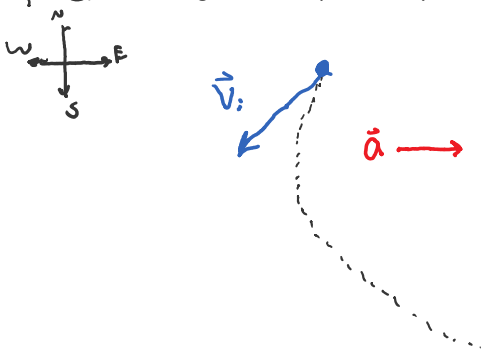
K2.L1.3-01:

Description: Spaceship accelerates in given direction conceptual question.

Learning Objectives: [1, 3]

Problem Statement: A spaceship is traveling in the galactic southwest direction. The ship's thrusters then create a large constant acceleration in the galactic east direction. Which of the following statements are *necessarily* true regarding the time after the thrusters have fired?

T (1) The ship will be moving in the southeast direction.
F (2) The ship will eventually be moving in the galactic east direction.
? (3) The ship's displacement will be in the galactic south direction.
T (4) The ship will eventually be moving with both southern and eastern components.
T (5) The change in the ship's velocity will be in the east direction.



K2.L1.3-02

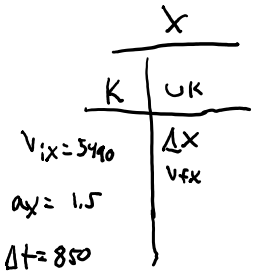
Description: Final velocity and displacement from acceleration and time .

Learning Objectives: [x]

Problem Statement: A spaceship is travelling with a velocity of $\mathbf{v}_{ix}$ = 5490 m/s along the +x direction and $\mathbf{v}_{iy}$ = 8850 m/s along the +y direction. Two engines are turned on for a time of 850 s. One engine accelerates the spaceship in the +x direction at $\mathbf{a}_x$ = 1.50 m/s^2, while the other engine accelerates the spaceship in the +y direction at $\mathbf{a}_y$ = -8.60 m/s^2.

(a) At the end of the firing, find $\mathbf{v}_{fx}$.

(1) 1275 m/s
(2) 1540 m/s
(3) 2234 m/s
(4) 2401 m/s
(5) 6765 m/s
(6) 7310 m/s
(7) 16,160 m/s



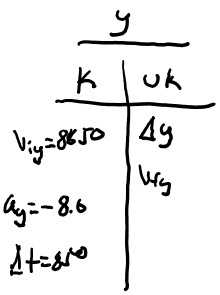
$$v_{fx} = v_{ix} + a_x \Delta t$$

$$= 5490 + 1.5(850)$$

$$\boxed{v_{fx} = 6765 \text{ m/s}}$$

(b) At the end of the firing, find $\mathbf{v}_{fy}$.

(1) 1275 m/s
(2) 1540 m/s
(3) 2234 m/s
(4) 2401 m/s
(5) 6765 m/s
(6) 7310 m/s
(7) 16,160 m/s



$$v_{fy} = v_{iy} + a_y \Delta t$$

$$= 8850 + (-8.6)(850)$$

$$\boxed{v_{fy} = 1540 \text{ m/s}}$$

(c) At the end of the firing, what is the displacement in kilometers?

(1) < 5.21 , 4.42 > x 10^3 km
(2) < 5.21 , 4.42 > x 10^6 km

(1) $< 5.21 , 4.42 > \times 10^3$ km
(2) $< 5.21 , 4.42 > \times 10^6$ km
(3) $< 5.21 , 10.6 > \times 10^3$ km
(4) $< 5.21 , 10.6 > \times 10^6$ km
(5) $< 542 , 3110 >$ km
(6) $< 542 , 3110 > \times 10^3$ km

$$\Delta x = v_{ix}\Delta t + \frac{1}{2}a_x \Delta t^2$$

$$= (5490)(850) + \frac{1}{2}(1.5)(850)^2$$

$$\simeq 5208375 \text{ m}$$

$$\Delta x \simeq 5.21 \times 10^6 \text{ m}$$

$$\Delta y = v_{iy}\Delta t + \frac{1}{2}a_y \Delta t^2$$

$$= (8850)(850) + \frac{1}{2}(-8.6)(850)^2$$

$$= 4415750 \text{ m}$$

$$\Delta y = 4.42 \times 10^6 \text{ m}$$

$$\Delta \vec{r} = \langle 5.21 \times 10^6 , 4.42 \times 10^6 \rangle \text{ m}$$

OR

$$\Delta \vec{r} = \langle 5.21 \times 10^3 , 4.42 \times 10^3 \rangle \text{ km}$$