

Lecture 9

(Exam 1 Review)

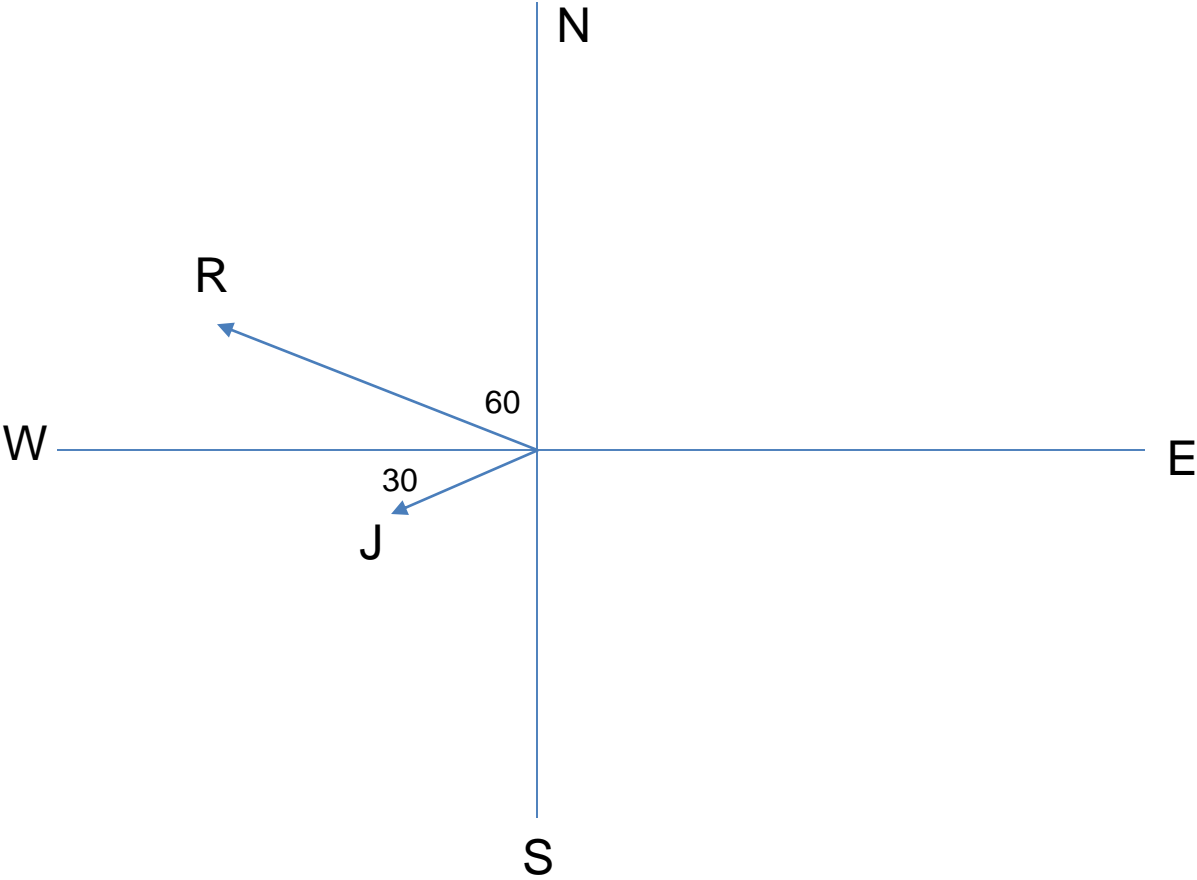
Physics 160-02 Spring 2017

Douglas Fields

Problem

1.76 ●● Ricardo and Jane are standing under a tree in the middle of a pasture. An argument ensues, and they walk away in different directions. Ricardo walks 26.0 m in a direction 60.0° west of north. Jane walks 16.0 m in a direction 30.0° south of west. They then stop and turn to face each other. (a) What is the distance between them? (b) In what direction should Ricardo walk to go directly toward Jane?

Solution



Problem

1.84 •• Two vectors \vec{A} and \vec{B} have magnitudes $A = 3.00$ and $B = 3.00$. Their vector product is $\vec{A} \times \vec{B} = -5.00\hat{k} + 2.00\hat{i}$. What is the angle between \vec{A} and \vec{B} ?

Solution

$$|\vec{A} \times \vec{B}| = |\vec{A}| |\vec{B}| \sin \theta_{AB}, \quad \vec{A} \times \vec{B} = (A_y B_z - A_z B_y) \hat{i} + (A_z B_x - A_x B_z) \hat{j} + (A_x B_y - A_y B_x) \hat{k}$$

Problem

1.85 •• You are given vectors $\vec{A} = 5.0\hat{i} - 6.5\hat{j}$ and $\vec{B} = 3.5\hat{i} - 7.0\hat{j}$. A third vector, \vec{C} , lies in the xy -plane. Vector \vec{C} is perpendicular to vector \vec{A} , and the scalar product of \vec{C} with \vec{B} is 15.0. From this information, find the components of vector \vec{C} .

Solution

$$\vec{A} \cdot \vec{B} = |\vec{A}| |\vec{B}| \cos \theta_{AB} = A_x B_x + A_y B_y + A_z B_z$$

Problem

2.77 ••• During your summer internship for an aerospace company, you are asked to design a small research rocket. The rocket is to be launched from rest from the earth's surface and is to reach a maximum height of 960 m above the earth's surface. The rocket's engines give the rocket an upward acceleration of 16.0 m/s^2 during the time T that they fire. After the engines shut off, the rocket is in free fall. Ignore air resistance. What must be the value of T in order for the rocket to reach the required altitude?

Solution

$$v_y = v_{0y} + a_y t$$

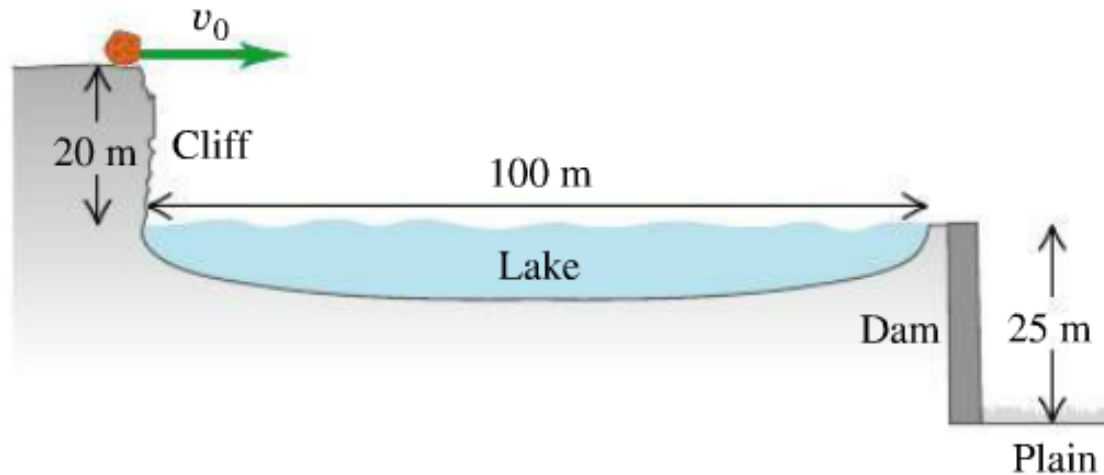
$$x = x_0 + v_{0x} t + \frac{1}{2} a_x t^2$$

$$v_x^2 = v_{0x}^2 + 2a_x (x - x_0)$$

Problem

- 3.65** • A 76.0-kg rock is rolling horizontally at the top of a vertical cliff that is 20 m above the surface of a lake (**Fig. P3.65**). The top of the vertical face of a dam is located 100 m from the foot of the cliff, with the top of the dam level with the surface of the water in the lake. A level plain is 25 m below the top of the dam. (a) What must be the minimum speed of the rock just as it leaves the cliff so that it will reach the plain without striking the dam? (b) How far from the foot of the dam does the rock hit the plain?

Figure **P3.65**



Problem

3.66 •• Tossing Your Lunch. Henrietta is jogging on the sidewalk at 3.05 m/s on the way to her physics class. Bruce realizes that she forgot her bag of bagels, so he runs to the window, which is 38.0 m above the street level and directly above the sidewalk, to throw the bag to her. He throws it horizontally 9.00 s after she has passed below the window, and she catches it on the run. Ignore air resistance. (a) With what initial speed must Bruce throw the bagels so that Henrietta can catch the bag just before it hits the ground? (b) Where is Henrietta when she catches the bagels?

Problem

3.74 •• An elevator is moving upward at a constant speed of 2.50 m/s . A bolt in the elevator ceiling 3.00 m above the elevator floor works loose and falls. (a) How long does it take for the bolt to fall to the elevator floor? What is the speed of the bolt just as it hits the elevator floor (b) according to an observer in the elevator? (c) According to an observer standing on one of the floor landings of the building? (d) According to the observer in part (c), what distance did the bolt travel between the ceiling and the floor of the elevator?