First assignment

1) A stone is thrown from the top of a building with an initial velocity of $20 m \cdot s^{-1}$ straight upward. The building is $50\ m$ high, and the stone just misses the edge of the roof on its way down. Taking the origin of axis on the ground, determine:

1° the time t_1 needed for the stone to reach its maximum height,

2° the maximum height H_m from the ground,

3° the time $t_0^{'}$ needed for the stone to return to the level of the thrower,

4° the velocity $v_0^{'}$ of the stone at this instant,

5° the velocity v and position y of the stone at $t = 5s$,

6° the velocity v_2 of the stone just before it hits the ground, and

7° the time t_2 the stone is in the air.

2) A particle moves along the positive x axis in such a way that its coordinate varies in time according to the expression $x = 4 + 2t - 3t^2$, where x is in m and t is in s.

1° Make a graph of x versus t for the interval $t = 0$ to $t = 2\ s$;

2° Determine the initial position and initial velocity of the particle;

3° Determine at what time the particle reaches a maximum position coordinate. (Note that at this time $v = 0$);

4° Calculate the coordinate, velocity, and acceleration at $t = 2\ s$.

3.

1.36. Let the angle θ be the angle that the vector $\vec{A}$ makes with the $+x$-axis, measured counterclockwise from that axis. Find the angle θ for a vector that has the following components: (a) $A_x = 2.00$ m, $A_y = -1.00$ m; (b) $A_x = 2.00$ m, $A_y = 1.00$ m; (c) $A_x = -2.00$ m, $A_y = 1.00$ m; (d) $A_x = -2.00$ m, $A_y = -1.00$ m.

1.37. A rocket fires two engines simultaneously. One produces a thrust of 725 N directly forward, while the other gives a 513-N thrust at 32.4° above the forward direction. Find the magnitude and direction (relative to the forward direction) of the resultant force that these engines exert on the rocket.

1.38. A postal employee drives a delivery truck over the route shown in Fig. 1.33. Use the method of components to determine the magnitude and direction of her resultant displacement. In a vector-addition diagram (roughly to scale), show that the resultant displacement found from your diagram is in qualitative agreement with the result you obtained using the method of components.

4.

1.39. For the vectors $\vec{A}$ and $\vec{B}$ in Fig. 1.34, use the method of components to find the magnitude and direction of (a) the vector sum $\vec{A} + \vec{B}$; (b) the vector sum $\vec{B} + \vec{A}$; (c) the vector difference $\vec{A} - \vec{B}$; (d) the vector difference $\vec{B} - \vec{A}$.

1.40. Find the magnitude and direction of the vector represented by the following pairs of components: (a) $A_x = -8.60$ cm, $A_y = 5.20$ cm; (b) $A_x = -9.70$ m, $A_y = -2.45$ m; (c) $A_x = 7.75$ km, $A_y = -2.70$ km.

$A_y = -2.70$ km.

Figure 1.33 Exercises 1.31 and 1.38.