

**Exercise 1.** Let  $A = (1, 2)$ ,  $B = (3, 1)$ . Draw the points  $A + B$ ,  $A + 2B$ ,  $A + 3B$ ,  $A - B$ ,  $A - 2B$ , and  $A - 3B$  on a sheet of graph paper (or a reasonably drawn set of axes).

**Exercise 2.** Which of the following pairs of vectors are perpendicular?

- $(1, -1, 1), (2, 1, 5)$
- $(1, -1, 1), (2, 3, 1)$
- $(-5, 2, 7), (3, -1, 2)$
- $(\pi, 2, 1), (2, -\pi, 0)$

**Exercise 3.** Suppose  $A = (a_1, a_2, a_3)$  is perpendicular to every vector  $X$ . Show that  $A$  is the zero vector.

**Exercise 4.** Determine the interior angles of the triangle whose vertices are  $(2, -1, 1)$ ,  $(1, -3, -5)$ , and  $(3, -4, -4)$ .

**Exercise 5.** Let  $A_1, \dots, A_r$  be vectors which are mutually perpendicular (i.e.  $A_i \cdot A_j = 0$  whenever  $i \neq j$ ). Suppose  $c_1, \dots, c_r$  are numbers such that

$$c_1 A_1 + \dots + c_r A_r = 0.$$

Show that we must have  $c_i = 0$  for each  $i = 1, \dots, r$ .

**Exercise 6.** Let  $P = (1, 3, -1)$  and  $Q = (-4, 5, 2)$ . Determine the coordinates of the following points

- The midpoint of the line segment between  $P$  and  $Q$
- The point on this line segment that is two thirds of the way from  $P$  to  $Q$ .