PHYSICS IN MOTION
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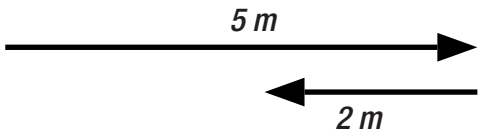
Unit 1F
Mathematical Resolution of Vectors
Practice Problems TEACHER

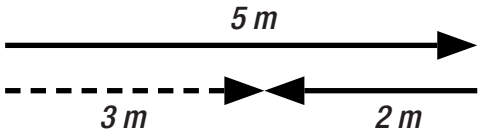
Work each of the following problems. SHOW ALL WORK.

1. **A dog runs 5 m to the right then comes back 2 m to the left.**

   a. Draw a vector diagram of the dog's movement.



   b. Use the tip-to-tail method to determine how far the dog moves from its initial position.

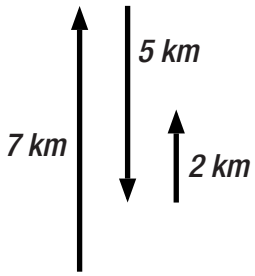


   c. Find the resultant displacement mathematically.

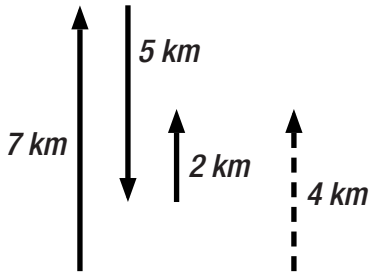
5m - 2m = 3m to the right

2. **A passenger rides the subway 7 km north, 5 km south, then 2 km north.**

   a. Draw a vector diagram of the passenger's movement on the subway.



   b. Use the tip-to-tail method to determine how far the passenger travels from her initial position.



   c. Find the resultant displacement mathematically.

7 km - 5 km + 2 km = 4 km north

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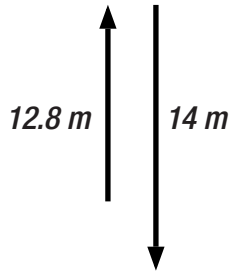
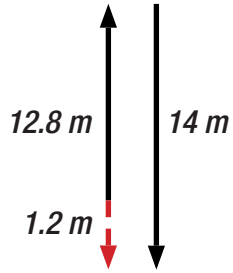
Work each of the following problems. SHOW ALL WORK.

3. A rocket launched from an initial height of 1.2 m reaches a height of 14 m then falls to the ground.

a. Draw a vector diagram of the rocket's movement.



b. How far away vertically does the rocket land from its initial position?



c. Find the resultant displacement mathematically.

-14 m + 12.8 m = -1.2 m (or 1.2 m below its original position)

4. While completing an obstacle course, a runner moves 30 m north, 20 m south, then another 5 m north. At the end of the course, how far away is the runner from his starting point?

Make north the positive direction and south the negative direction:

$$R_{TOT} = R_1 + R_2 + R_3$$
$$R_{TOT} = 30\ m - 20\ m + 5\ m$$
$$R_{TOT} = 15\ m\ north$$

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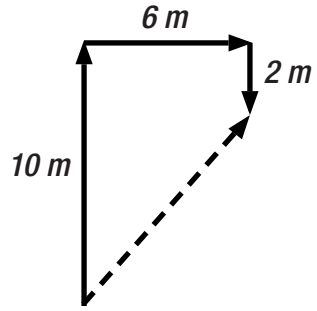
Work each of the following problems. SHOW ALL WORK.

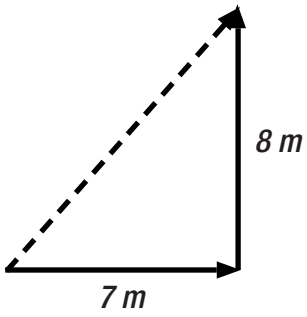
5. **Two children chase each other through a playground, running 10 m north, 6 m east, then 2 m south. At the end of the game, how far are the children from where they started? Use a component table to solve.**



Vector	x-component	y-component
1	*0 m*	*+ 10 m*
2	*+ 6 m*	*0 m*
3	*0 m*	*- 2 m*
TOTAL	***+ 6 m***	***+ 8 m***

$R = \sqrt{(\Sigma x)^2 + (\Sigma y)^2}$
$R = \sqrt{(6\ m)^2 + (8\ m)^2}$
$R = \sqrt{36\ m^2 + 64\ m^2}$
$R = \sqrt{100\ m^2}$
$R = 10\ m$ *north of east*

6. **The local high school is installing new bleachers at the stadium and must also add handrails to meet code. The students know the bleachers are 8 m tall, and they measure the depth of the bleachers at 7 m. How long must the handrails be to go along the bleachers from bottom to top? Use a component table to solve.**



Vector	x-component	y-component
1	*0 m*	*8 m*
2	*7 m*	*0 m*
TOTAL	***7 m***	***8 m***

$R = \sqrt{(\Sigma x)^2 + (\Sigma y)^2}$
$R = \sqrt{(7\ m)^2 + (8\ m)^2}$
$R = \sqrt{49\ m^2 + 64\ m^2}$
$R = \sqrt{113\ m^2}$
$R = 10.63\ m$

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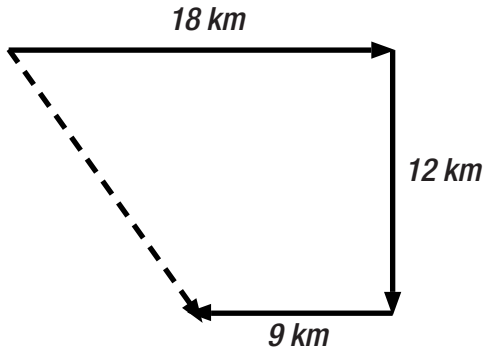
Work each of the following problems. SHOW ALL WORK.

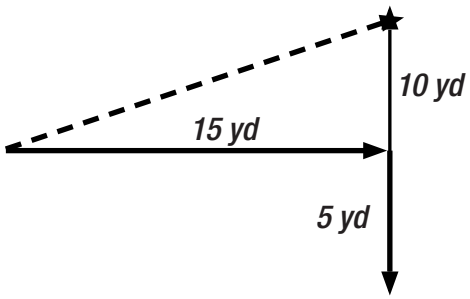
7. How far away from her initial position is a cyclist who travels 18 km east, 12 km south, and 9 km west during her ride? Use a component table to solve.



Vector	x-component	y-component
1	*+ 18 km*	*0 km*
2	*0 km*	*- 12 km*
3	*- 9 km*	*0 km*
TOTAL	***9 km***	***- 12 km***

$$R^2 = \sqrt{(\Sigma x)^2 + (\Sigma y)^2}$$
$$R^2 = \sqrt{(9\ km)^2 + (-12\ km)^2}$$
$$R^2 = \sqrt{81\ km^2 + 144\ km^2}$$
$$R^2 = \sqrt{225\ km^2}$$
$$R = 15\ km \text{ south of east}$$

8. While performing the halftime show on Friday night, a marcher completes a path that is 15 yd east, 5 yd south, and 10 yd north. How far is the marcher from his initial position? Use a component table to solve.



Vector	x-component	y-component
1	*+ 15 yd*	*0 yd*
2	*0 yd*	*- 5 yd*
3	*0 yd*	*+ 10 yd*
TOTAL	***+ 15 yd***	***+ 5 yd***

$$R^2 = \sqrt{(\Sigma x)^2 + (\Sigma y)^2}$$
$$R^2 = \sqrt{(15\ yd)^2 + (5\ yd)^2}$$
$$R^2 = \sqrt{225\ yd^2 + 25\ yd^2}$$
$$R^2 = \sqrt{250\ yd^2}$$
$$R = 15.81\ yd \text{ north of east}$$

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