

## Vectors Worksheet #4

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Use the formula  $Work = \|F\| \|d\| \cos\theta$  to find the work done (in joules) by the force F, with given magnitude and direction, in moving an object the given distance at the given angle.

(F is the force vector, d is the direction vector,  $\theta$  is the angle between F and d)

1. force of 15 N at  $45^\circ$  along a ramp 60 meters long at  $30^\circ$ .
  2. force of 91 N at  $10^\circ$  along a ramp 100 meters long at  $10^\circ$ .
  3. force of 15 N at  $24^\circ$  up a vertical cable a distance of 25 meter.
  4. force of 422.36 N at  $82^\circ$  up a vertical cable a distance of 1 meter.
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Draw a figure to solve each of the following problems on a inclined plane.

5. What is the weight of a car sitting on a  $14^\circ$  slope if the force required to push the car up the hill is 750 pounds.?
  6. What is the force required to push a 40 pound lawn mower up a hill inclined at  $8^\circ$ ?
  7. A 3000 pound car is sitting on a  $12^\circ$  slope. Find the magnitude of the force required to push the car up the slope and the magnitude of the force holding the car on the slope?
  8. Two men push a 200 pound box up a ramp. Each man pushes with a force of 75 pounds in the direction of the incline of the ramp, and the box just moves up the ramp. At what angle is the ramp inclined?
  9. Find the amount of work done by a force F of 12 N at  $50^\circ$  in moving a box of apples 30 meters up a ramp inclined at  $20^\circ$
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### Solve each of the following using vectors.

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10. Two forces of 692 N and 423 N acts at a point. The resultant force is 786 N. Find the angle between the forces.
  11. Three forces acting at a point are in equilibrium. The forces are 980 lbs, 760 lbs. and 1220 lbs. Find the angles between the forces ( to the nearest minute)
  12. A force of 176 lbs. Makes an angle of  $78^\circ 50'$  with a second force. The resultant of the two forces makes an angle of  $41^\circ 10'$  with the first force. Find the magnitude of the second force and the resultant.
  13. A force of 28.7 lbs. makes an angle of  $42^\circ 10'$  with a second force. The resultant of the two forces makes an angle of  $32^\circ 40'$  with the first force. Find the magnitude of the resultant.
  14. A crate is supported by two ropes. One rope makes an angle of  $46^\circ 20'$  with horizontal and has a tension of 89.6 lbs. on it. The other rope is horizontal. Find the weight of the crate and the tension in the horizontal rope.
  15. Two people are carrying a box, one on each side of the box. One person exerts a force of 150 lbs. at an angle of  $62.4^\circ$  with horizontal. The other person exerts a force 114 lbs. at an angle of  $54.9^\circ$  with horizontal. Find the weight of the box.
  16. Two tugboats are pulling a disabled speed boat into port with forces of 1240 lbs. and 1480 lbs. The angle between these forces is  $28.2^\circ$ . Find the direction and magnitude of the equilibrant.
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### Answers:

1. 869.33 joules	2. 9100 joules	3. 152.53 joules	4. 418.25 joules
5. 3100.17 lbs.	6. 5.57 lbs.	7. Force to push the car up the hill: 623.74 lbs.  Force to keep the car on the hill: 2934.44 lbs.	8. 48.59°
9. 311.77 joules	10. 93.92°	11. 91.92°, 141.49°, 126.6°	12. $F_2$ : 189.59 lbs, r: 282.57 lbs.
13. 116.73 lbs	14. W: 64.8 lbs T: 61.9 lbs	15. 226.2 lbs	16. 2638.7 lbs 167.2° from 1480 lb force 164.6° from 1240 lb force