Physics 12 **Vector Kinematics Quiz # 1** Name:_____

1.

1. Which one of the following statements best describes vectors? (JUNE '90)

   A. All vectors have direction only.
   B. All vectors have magnitude only.
   C. All vectors have both magnitude and direction.
   D. All vectors are directed towards the earth's centre.

2.

1. Which of the following is a vector quantity? (JAN '95)

   A. work
   B. speed
   C. acceleration
   D. kinetic energy

3.

1. Which one of the following is a vector quantity? (JAN. '94)

   A. time
   B. speed
   C. energy
   D. displacement

4.

1. Which one of the following contains two vector quantities? (JUNE '92)

   A. Mass, velocity
   B. Time, momentum
   C. Force, acceleration
   D. Speed, displacement

5.

1. Which one of the following is **not** a vector quantity? (JUNE '91)

   A. Work.
   B. Impulse.
   C. Velocity.
   D. Displacement.

Physics 12 \ tor Kinematics Qu # 2 Name: ____

. A rock is falling from a building. While the rock is falling, which one of the following remains constant? (JUNE '93)

A. speed
B. velocity
C. momentum
D. acceleration

2. An airplane heads due west with an airspeed of 78 m/s. The wind is blowing due north at 25 m/s. What is the speed of the airplane relative to the ground? (JAN. '93)

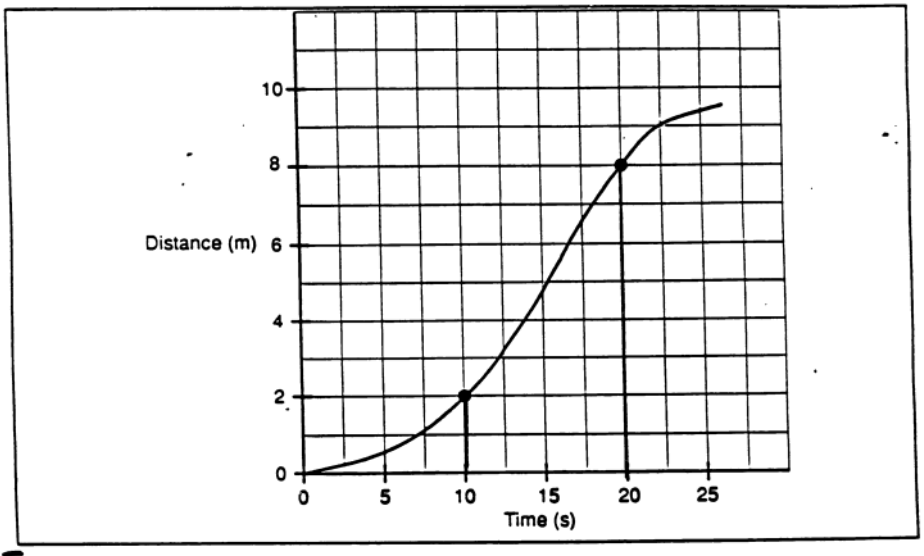
A. 53 m/s
B. 78 m/s
C. 82 m/s
D. 103 m/s

3. A car is travelling at a constant speed of 26.0 m/s down a slope which is 12.0° to the horizontal. What is the vertical component of the car's velocity? (JAN '94)

A. 5.41 m/s
B. 9.80 m/s
C. 25.4 m/s
D. 26.0 m/s

4. An object was initially moving east at 13.0 m/s. One second later it was moving north at 28.0 m/s. In what direction was the average acceleration? (JAN '91)

A. 65° N of W
B. 65° S of W
C. 65° N of E
D. 65° S of E



5 3. The above graph shows the distance travelled by an object plotted against time. What is the object's average speed during the time interval $t = 10\,s$ to $t = 20\,s$? (JAN '90)

A. 0.40 m/s
B. 0.60 m/s
C. 0.80 m/s
D. 1.7 m/s

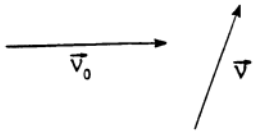
Physics 12

Vector Kinematics Quiz # 3

Name:_____

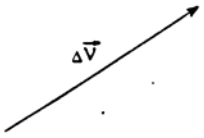
1.

2. Initial velocity vector $\vec{V}_0$ and final velocity vector $\vec{V}$ are shown below. (JAN '95)

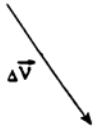


Which of the following represents the change in velocity $\Delta\vec{V}$?

A.

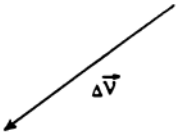


B.



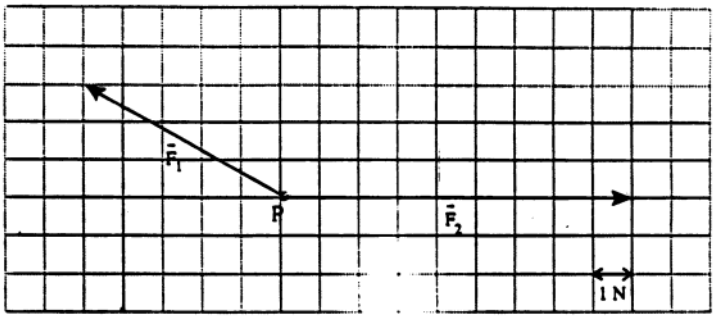
C.

D.



2.

2. The diagram below shows two force vectors $\vec{F}_1$ and $\vec{F}_2$ acting on an object at point P. (JUNE '92)



What is the magnitude of the resultant force?

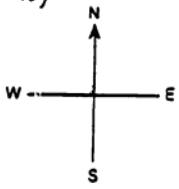
A. 3.0 N
B. 5.0 N
C. 7.0 N
D. 14.3 N

3.

3. A vehicle travelling north at 9.0 m/s changes its velocity to 12 m/s west. Which one of the following best represents its change in velocity? (JUNE '90)

A.

B.

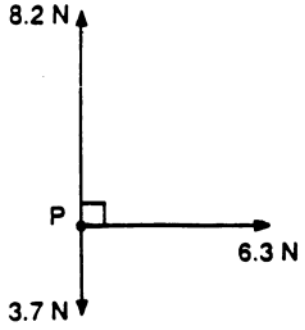


C.

D.

4.

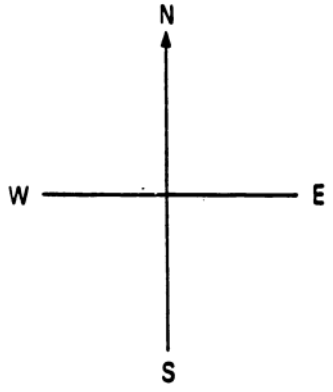
8. Three forces act at point P as shown in the following diagram.

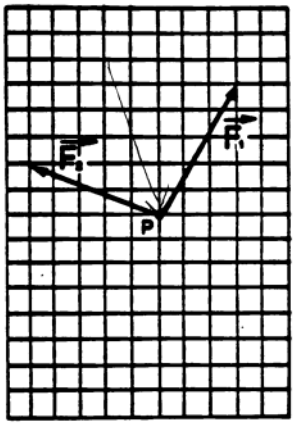


What is the magnitude of a single force required to achieve static equilibrium? (JAN '91)

A. 7.2 N
B. 7.7 N
C. 10 N
D. 13 N

Use the following diagram to answer question 8.





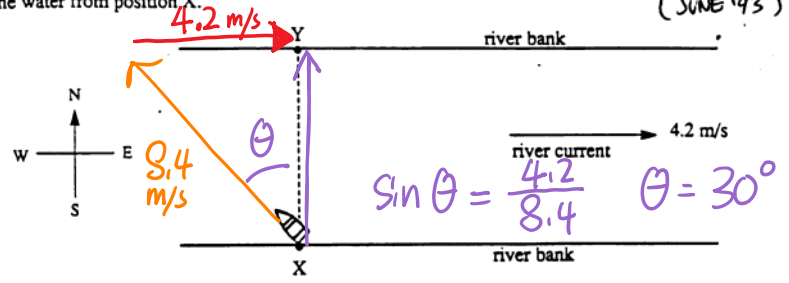
5.

8. The above diagram shows two forces $\vec{F}_1$ and $\vec{F}_2$ acting on an object at point P. What is the direction of a third force that would produce a condition of static equilibrium? (JUNE '90)

A. 74° N of E
B. 74° S of E
C. 74° N of W
D. 74° S of W

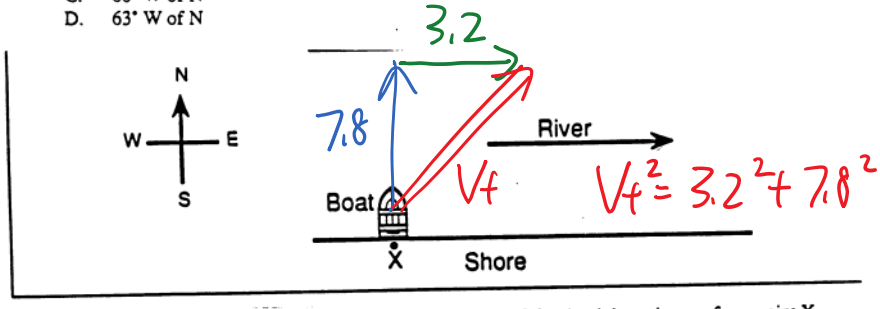
Physics 12 — Vector Kinematics Quiz # 4 — Name:_____

1. 2. As shown in the diagram below, the river flows east at 4.2 m/s. A boat departs at 8.4 m/s relative to the water from position X. (JUNE '93)



In what direction should the boat head to reach position Y directly across the river? (JUNE '93)

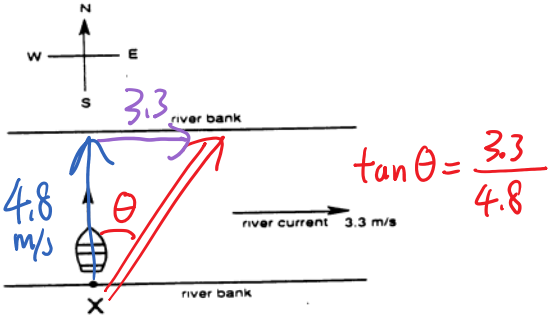
A. 27° W of N
B. 30° W of N
C. 60° W of N
D. 63° W of N



2. 2. As shown in the above diagram, a river is flowing east at 3.2 m/s. A boat departs from point X heading due north at a speed of 7.8 m/s relative to the water. What is the boat's speed relative to point X?

A. 4.6 m/s
B. 7.1 m/s
C. 8.4 m/s
D. 11.0 m/s

3. 3. As shown in the diagram below, the river flows eastward at 3.3 m/s. A boat can travel at 4.8 m/s relative to still water. (JUNE '91)

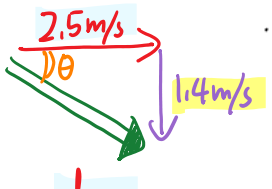


If the boat departs from position X heading due north, in what direction will this boat travel relative to position X? (JUNE '91)

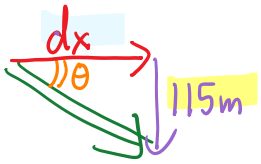
A. due north
B. 35° E of N
C. 43° E of N
D. 47° E of N

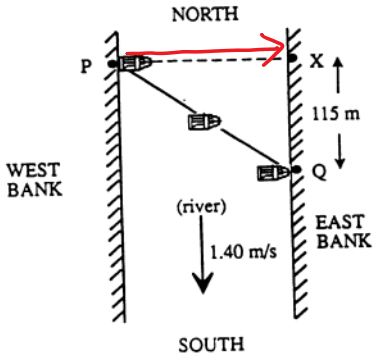
4. 4. A boat departs from point P heading towards point X as shown in the diagram below. Its speed relative to the water is 2.50 m/s. The river is flowing south at 1.40 m/s so that the boat actually touches the east bank at point Q. (JAN '92)

Vel



Dist





$V_y = \frac{dy}{t}$

$1.4 = \frac{115}{t}$ $t = 82.14$ sec

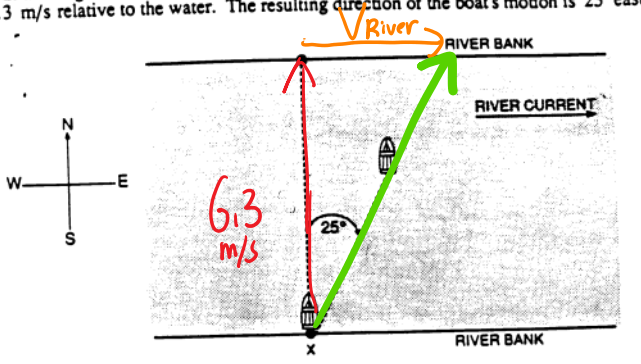
$V_x = \frac{dx}{t}$

$2.5 = \frac{dx}{82.14}$

If Q is 115 m downstream from point X, how wide is the river?

A. 40.0 m
B. 82.0 m
C. 2.05×10^2 m ← 205 m
D. 2.35×10^2 m

5. 3. As shown in the diagram below, a river flows east. A boat departs from position X heading due north at 6.3 m/s relative to the water. The resulting direction of the boat's motion is 25° east of north.



What is the speed of the current relative to the river bank? (JAN '91)

A. 2.7 m/s
B. 2.9 m/s
C. 5.7 m/s
D. 6.3 m/s

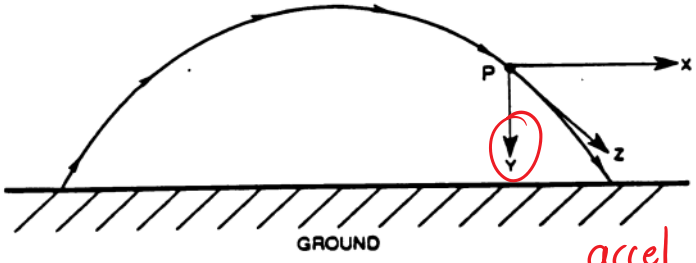
$\tan(25°) = \frac{V_{River}}{6.3}$ $V_R = 2.9$ m/s

Physics 12 **Vector Kinematics Quiz # 5** Name:_____

1. 1. Which one of the following is correct for a projectile's motion, assuming no air friction? (JAN '92)

	HORIZONTAL SPEED	VERTICAL ACCELERATION
A.	constant	constant ← always −9.8
B.	constant	changing
C.	changing	constant
D.	changing	changing

2. 2. The diagram below shows the path of a projectile over level ground.



Which one of the above arrows best represents the direction of the net force (accel) on the projectile at point P? (JAN '91)

A. Zero (no arrow).
B. Vertical (arrow Y).
C. Horizontal (arrow X).
D. Tangent to the curve (arrow Z).

3. 3. A projectile is fired with an initial velocity of 120 m/s at an angle of 30° above the horizontal. If air resistance is negligible, how much time elapses before the projectile strikes the ground at the same elevation from which it was fired? (JUNE '90)

A. 6.1 s
B. 11 s
C. 12 s
D. 21 s

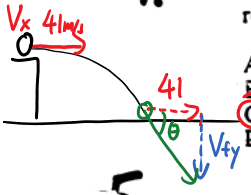
$V_{iy} = 120 \sin 30 = 60 m/s$

$V_{iy} = 60$
$V_{fy} = -60$
$a = -9.8$
$t = ?$

$V_f = V_i + at$
$-60 = 60 + (-9.8)t$
$t = 12.2 sec$

4. 4. A rock is thrown horizontally with an initial speed of 41 m/s from a cliff 32 m above a lake. If air resistance is negligible, what is the velocity of the rock at the moment of its impact with the water? (JAN '90)

A. 45 m/s, 23° from the horizontal
B. 45 m/s, 67° from the horizontal
C. 48 m/s, 31° from the horizontal
D. 48 m/s, 59° from the horizontal



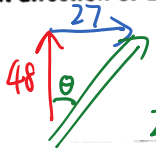
$V_{iy} = 0$
$d = -32m$
$a = -9.8$
$V_{fy} = ?$

$V_f^2 = V_i^2 + 2ad$
$V_{fy}^2 = 2(-9.8)(-32)$
$V_{fy} = -25 m/s$

$V_f^2 = 41^2 + 25^2$
$V_f = 48 m/s$
$\theta = \tan^{-1}(\frac{25}{41})$
$\theta = 31.4°$

5. 2. An aircraft heading due north at 48 m/s encounters a wind blowing towards the east at 27 m/s. What is the aircraft's resultant direction of travel? (JUNE '90)

A. 29° E of N
B. 34° E of N
C. 56° E of N
D. 61° E of N



$\theta = \tan^{-1}(\frac{27}{48})$
$29°$

Physics 12 **Vector Kinematics Quiz # 6** Name:_____

1. 3. A projectile is launched with a velocity of 23 m/s at 57° above the horizontal. What is maximum height reached by the projectile? (JUNE '93)

A. 8.0 m
B. 19 m
C. 27 m
D. 64 m

y-dir
$V_{iy} = 23 \sin 57° = 19.3$ m/s
$V_f = 0$ @ max only !!!
$a = -9.8$
$d = ?$

23 m/s, 57°

$V_f^2 = V_i^2 + 2ad$
$0 = 19.3^2 + 2(-9.8)d$
$d = 19$ m

2. 3. A projectile is launched over level ground with a speed of 240 m/s at 35° to the horizontal. If friction is negligible, what is the height of the projectile 17 s after launch? (JAN '95)

A. 9.2×10^2 m
B. 1.9×10^3 m
C. 2.7×10^3 m
D. 5.5×10^3 m

y-dir
$V_{iy} = 240 \sin 35° = 138$ m/s
$t = 17$ sec
$a = -9.8$
$d = ?$

240 m/s, 35°

$d = V_i t + \frac{1}{2} a t^2$
$d = 138(17) + \frac{1}{2}(-9.8)(17)^2$
$d = 924$ m

3. 5. A projectile is fired with an initial velocity of 80 m/s at an angle of 37° above the horizontal. If air resistance is negligible, how much time elapses before the projectile reaches its maximum height? (JUNE '92)

A. 4.9 s
B. 6.5 s
C. 8.2 s
D. 16 s

y-dir
$V_{iy} = 80 \sin 37° = 48$
$V_f = 0$ @ max
$t = ?$
$a = -9.8$

80, 37°

$V_f = V_i + at$
$0 = 48 + (-9.8)t$
$t = 4.9$ sec

4. 8. A 0.15 kg ball rolls off a bench at 2.4 m/s as shown in the diagram below. What is the vertical component of the ball's momentum when it strikes the floor 0.85 m below? (JAN '95)

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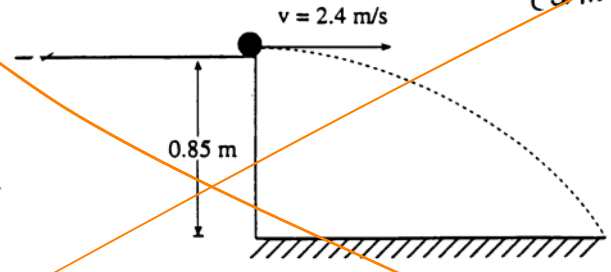
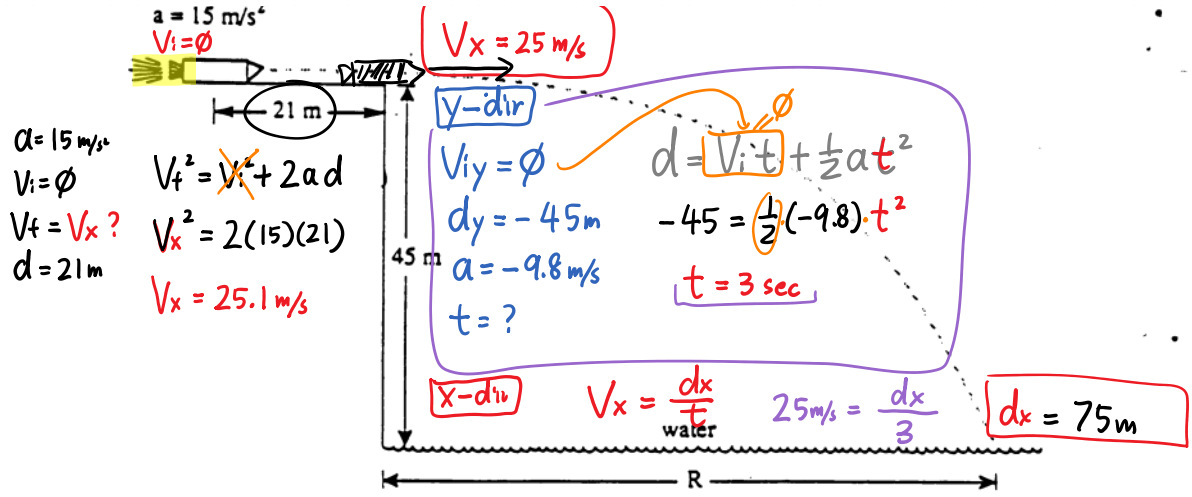


A. 0.36 kg·m/s
B. 0.61 kg·m/s
C. 0.71 kg·m/s
D. 1.2 kg·m/s

5. A rocket accelerates at 15 m/s² from rest for 21 m on a frictionless horizontal surface. The rocket stops firing at the cliff and falls freely from a height of 45 m.

$a = 15$ m/s²
$V_i = 0$

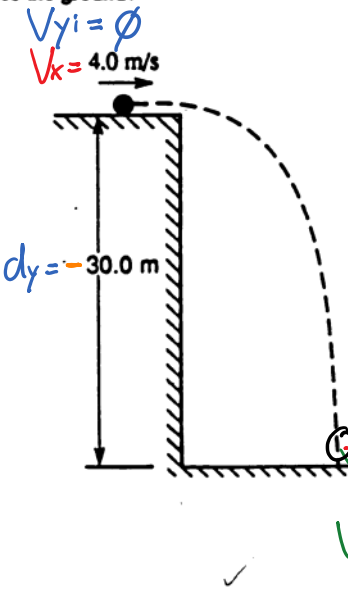
$V_x = 25$ m/s



If air resistance is not significant, what is the distance R when the rocket hits the water?

(7 marks)

6. A ball travelling horizontally at 4.0 m/s rolls off a 30.0 m cliff. What will be its velocity (magnitude and direction) as it reaches the ground? (7 marks)



y-dir

Viy = ø dy = -30

a = -9.8 Vfy = ?

$V_f^2 = V_i^2 + 2ad$

$V_f^2 = ø + 2(-9.8)(-30)$

$V_f = -24.2$ m/s

$V_f^2 = 4^2 + 24.2^2$ $V_f = 24.6$ m/s

$\tan\theta = \frac{24.2}{4}$ $\theta = 81°$ below horizontal.

↑ keep ⊕ for

$a^2 + b^2 = c^2$

$\tan\theta = \frac{opp}{adj}$

Physics 12

Vector Kinematics Quiz # 7

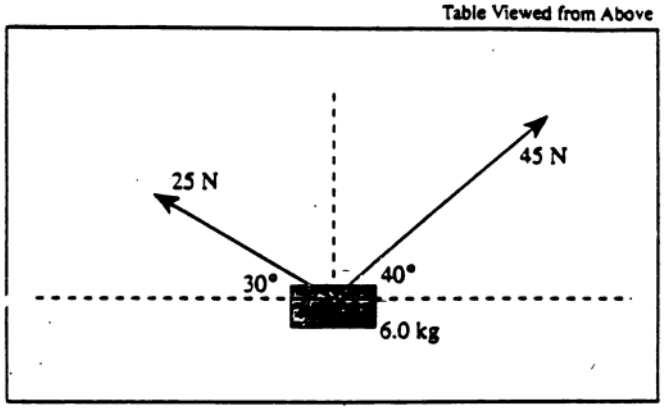
Name: _____

1. A 1.50 kg projectile is launched at 18.0 m/s from level ground. The launch angle is 26.0° above the horizontal. (Assume negligible friction.)

   a) What is the maximum height reached by this projectile? **(5 marks)**

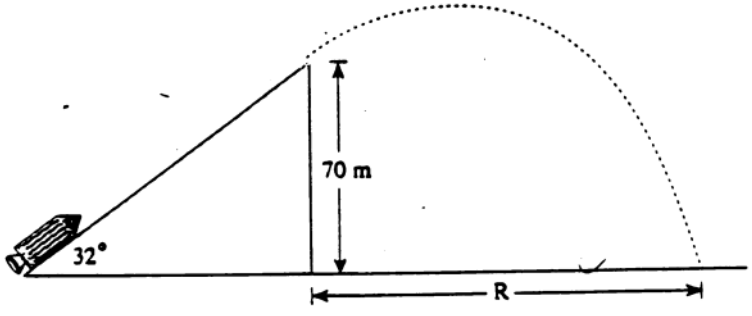
   b) How fast will the projectile be travelling when it is at its maximum height? **(2 marks)**

2. A 6.0 kg block is held at rest on a horizontal, frictionless air table. Two forces are pulling on this block in the directions shown in the diagram below.



What will be the magnitude of the acceleration on the 6.0 kg block at the moment it is released? **(7 marks)**

3. A rocket accelerates at 25 m/s^2 from rest on a frictionless inclined surface. The rocket stops firing at the instant it leaves the incline.



If air resistance is negligible, what is the distance R to the point of impact? **(12 marks)**