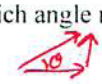
Name: KEY Per:____

REVIEW SHEET – Vectors and Two Dimensional Motion

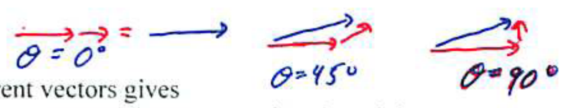
1. Read Chapter 3
2. **Terms to know**: concurrent vectors, component vectors, resultant vector, trajectory, projectile, range, half-time.
3. You should be able to. . .
   a) add two vectors together by the scale method and the mathematical method.
   b) find the resultant vector from two concurrent vectors.
   c) find the components of a resultant vector by the scale method and the mathematical method.
   d) sketch vectors representing the velocity and acceleration of a projectile at any point in its path.
4. A resultant vector is determined by finding its magnitude and direction.
5. Which angle represents the direction of the resultant vector?

   
   usually angle w/respect to horizontal.
6. Compare the placement of the component vectors to the placement of the resultant vector.

   tip-to-tail vs. start to end
7. What must be done to concurrent vectors before a resultant can be found?

   place them tip to tail
8. As the angle between two concurrent vectors increases, what happens to the resultant vector?

   Decreases

   
   
9. What angle between two concurrent vectors gives
   a) the maximum resultant? 0°
   b) the minimum resultant? 180°
10. Two forces of 50 N and 30 N act concurrently. What is range of possible values for the magnitude of the resultant?

    20N - 80N
11. As the angle a vector makes with the horizontal increases, what happens to the
    a) horizontal component? decreases
    b) vertical component? increases
12. Describe the horizontal and vertical motion of a projectile.

    constant vel. const. acceleration
13. A rock is thrown horizontally from the top of a tall cliff at 5.0 m/s at the same time an identical rock is dropped. Neglecting air resistance, compare for the two rocks
    a) the time taken to hit the ground. $d_y = v_{oy}t + \frac{1}{2}a_y t^2$
       same
    b) the initial velocity in the horizontal direction.
       thrown rock $V_{ox}$ = constant, dropped rock $V_{ox} = 0$
    c) the initial velocity in the vertical direction.
       same (Both zero)
    d) the horizontal acceleration.
       same (Both zero)
    e) the vertical acceleration.
       same (Both 9.8 m/s² down)

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14. Sketch the following graphs for a horizontal projectile in both the horizontal and vertical directions.

15. A football is kicked at an angle of $30^0$ to the horizontal. Sketch the following graphs for the football in both the horizontal and vertical directions.

16. As the angle of launch of a football increases, what happens to the horizontal and vertical components of its initial velocity?

horizontal - decreases
vertical - increases

17. What angle(s) of launch gives
    a) the largest range? 45°
    b) the longest flight time? 90°
    c) the greatest altitude? 90°
    d) the same range? 30° + 60°

18. A stone is thrown horizontally at 15.0 m/s from the top of a cliff 78.4 m high.
    a) How long does it take the stone to reach the bottom of the cliff?

$d_y = V_{0y}t + \frac{1}{2}a_y t^2 \quad t = \sqrt{2d/a} = \sqrt{\frac{2 \cdot 78.4\,m}{9.8\,m/s^2}}$ 4s

    b) How far from the base of the cliff does the stone strike the ground?

$d_x = V_{0x}t + \frac{1}{2}a_x t^2 = 15\,m/s \cdot 4s =$ 60m

    c) What are the X and Y components of the velocity of the stone just before it strikes the ground?

$V_x = const = 15.0\,m/s \qquad V_{fy}^2 = V_{0y}^2 + 2a_y d \quad V_{fy} = \sqrt{2 \cdot d_y a_y} = \sqrt{2 \cdot 78.4\,m \cdot 9.8\,m/s^2}$
$= 39.2\,m/s$

    d) What is the magnitude of the velocity of the stone just before it hits the ground?

$V_f = \sqrt{V_{fx}^2 + V_{fy}^2} = \sqrt{(15\,m/s)^2 + (39.2\,m/s)^2} =$ 42.0 m/s

19. A player kicks a football from ground level at 27.0 m/s at an angle of $30.0^0$ above the horizontal. Calculate:
    a) The x and y components of the initial velocity.

$V_{0x} = V_0 \cos 30° \qquad V_{0y} = V_0 \sin 30°$

    b) The time the ball is in the air.

at top $V_{fy} = 0 \Rightarrow V_{fy} = V_{0y} + a_y t \Rightarrow t = \frac{V_{0y}}{a_y} =$ ____ double this: ____

    c) The distance the ball travels before it hits the ground.

$d_x = V_{0x}t + \frac{1}{2}a_x t^2$

    d) The maximum height it reaches.

at $t^{1/2}$, $V_{fy} = 0$, $t = t_{1/2}$ $\quad d_y = V_{0y}t + \frac{1}{2}a_y t^2$



*Answers:* 18. a) 4.00 s b) 60.0 m c) $v_x = 15.0\,m/s$ $v_y = -39.2\,m/s$ d) 42.0 m/s 19. a) $v_{0x} = 23.4\,m/s$ $v_{0y}$ 13.5 m/s b) 2.76 s c) 64.6 m d) 9.34 m