



Highlander Help

This site was created for *you*

Here you will find answers, explanations, and resources to guide you through the homework and develop a better understanding of the material

You deserve to succeed and to have more time to do the things you love to do.

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Good Luck!

$$2(7.33 + 0j)(1200 + 0j) = (200i + 0j)^2 + (x, y)^2$$

$$17592i \quad 0j$$

$$40000i \quad 0j$$

Version B

1. An airplane accelerates with $(7.33i + 0j) \text{ m/s}^2$ from an initial velocity $(200i + 0j) \text{ m/s}$ for a distance of $(1.20i + 0j) \text{ km}$. What is the final velocity in m/s?

- a. ~~$(440i + 200j)$~~
 b. $(500i + 0j)$
 c. $(240i + 0j)$
 d. ~~$(240i + 200j)$~~
 e. ~~$(200i + 240j)$~~

$$v_0(200i + 0j)$$

$$1,000 \text{ m}$$

$$1 \text{ km}$$

$$D = 1.20$$

$$\text{initial } v = 200$$

$$a = 7.33$$

$$x = v_0 t$$

$$\frac{1200 \text{ m}}{200 \text{ m/s}} = \frac{3}{1} \text{ s}$$

$$2(7.33)(1200) = 200^2$$

$$17592 = 40,000 - x^2$$

$$2ax = v^2 - v_0^2$$

$$\frac{1200}{200} =$$

$$2(7.33)(1200) = v^2 - (200)^2 \frac{\text{m}}{\text{s}}$$

$$\vec{v} = \vec{v}_i + \vec{a}t$$

$$v = (200i + 0j) + (7.33 + 0j)t$$

2. A car drives carrying a flag of width $w = 0.5 \text{ m}$. When the flag goes through a photogate, it blocks and unblocks a light. If the average speed of the car is 20 m/s , what is the photogate time interval in seconds?

- a. 40
 b. 4
 c. 0.25
 d. 0.025
 e. 0.01

$$d \cdot t = \text{speed}$$

$$0.5 \text{ m} \cdot x = \frac{20 \text{ m}}{\text{s}}$$

$$\frac{0.5}{20}$$

$$\frac{0.5 \text{ m}}{x \text{ s}} = \frac{20 \text{ m}}{\text{s}}$$

$$20x = \frac{0.5}{20}$$

3. A jet test pilot can accelerate at "5g" ($5 \times 9.8 \text{ m/s}^2$). At that acceleration she will black out in 5 s. She plans to start from rest and to speed up to Mach 3 ($3 \times 331 \text{ m/s}$). How long (in s) would this part of her planned flight take, if she can do it?

- a. 20
 b. 15
 c. 200
 d. 4
 e. 1

$$v_0 = 0$$

$$v_f = 3 \cdot 331 \text{ m/s}$$

$$a = 5 \cdot 9.8 \text{ m/s}^2$$

$$3 \cdot 331 = 0 + (5 \cdot 9.8)t$$

$$v = v_i + at$$

$$(3 \cdot 331 \text{ m/s}) = 0 + (5 \cdot 9.8) \cdot x$$

Version B

4. A student is driving a car at 60.0 miles/hr. What is its speed in m/s? There are 3.28 feet in a meter and 5280 feet in a mile.

- a. 2.24
- b. 27
- c. 134
- d. 45
- e. 23

$$\frac{60 \text{ mi}}{1 \text{ hr}} \cdot \frac{5280 \text{ ft}}{1 \text{ mi}} \cdot \frac{1 \text{ m}}{3.28 \text{ ft}} \cdot \frac{1 \text{ hr}}{60 \text{ min}} \cdot \frac{1 \text{ min}}{60 \text{ sec}}$$

26.8

5. How many million gallons of blood does a human heart pump in an average lifetime? The average number of beats in a lifetime is about 3000 million and the volume pumped with each beat is about 50 cm³. A gallon is 3800 cm³.

- a. 39
- b. 228,000
- c. 150,000
- d. 0.79
- e. 47

$$3000 \cdot 1,000,000$$

$$3,000,000,000$$

$$50 \text{ cm}^3 \cdot \frac{1 \text{ gallon}}{3800 \text{ cm}^3}$$

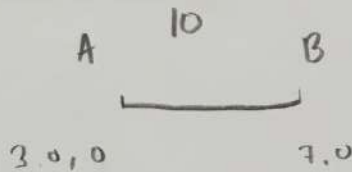
$$3800 \text{ cm}^3$$

gallons per pump

39,473,684

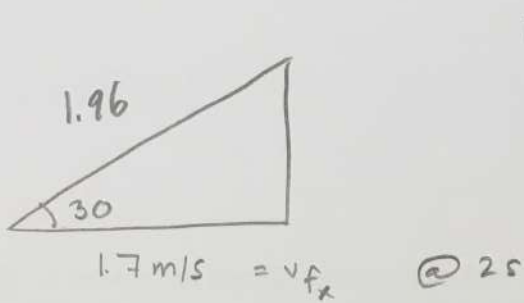
6. Car A starts 10 meters ahead of car B. Car A moves at $v_A = (3.0 \text{ i} + 0 \text{ j}) \text{ m/s}$ and Car B moves forward at $v_B = (7.0 \text{ i} + 0 \text{ j}) \text{ m/s}$. How many seconds does it take car B to catch up?

- a. 2.5
- ~~b. 3.3~~
- ~~c. 1.4~~
- ~~d. 10~~
- ~~e. 7~~



| | | |
|-----|-----|-----|
| 0 | 0 | -10 |
| 1 | 3 | -3 |
| 2 | 6 | 4 |
| 2.5 | 7.5 | 7.5 |
| 3 | 9 | 11 |

| | | | | | |
|-----|----|---|----|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 |
| 0 | 3 | 6 | 9 | | |
| -10 | -3 | 4 | 11 | | |

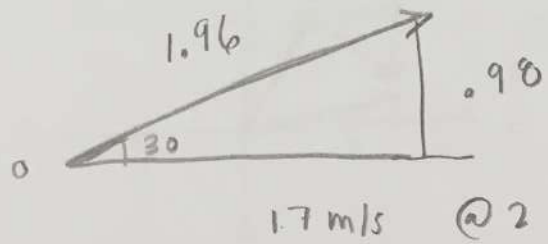
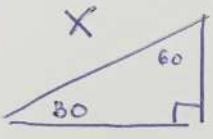


$1.96 = v_f$ $t = 2$
 $v_0 = v_0$

$v = \frac{v^2 \sin 2\theta}{g}$ constant

7. The launch angle of a projectile is 30 degrees and its velocity in the x direction is 1.7 m/s after 2s. Neglecting friction, what is the initial magnitude of the projectile's velocity along its firing direction?

- a. 0
- b. 1.7
- c. 0.6
- d. 2
- e. 3.4



$t = 2$
 $v_f = 1.96$
 v_0

$1.7 \text{ m/s} \quad 1.96 @ 2$

$x \cos 30 = 1.7$

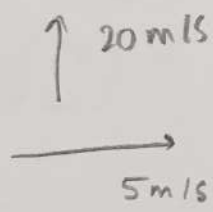
$v_0 (2) + \frac{1}{2}$

$x \cos 30 = 1.7$
 $\cos 30$

- 1.96
- 2

8. A rocket-launching vehicle is moving forward at a constant velocity of 5 m/s. A cannon on the vehicle shoots a shell straight up with a velocity of 20 m/s. The shell moves without friction, (no air resistance). How high does the shell go, in m?

- a. 1
- b. 10
- c. 40
- d. 2.0
- e. 20.



$v_f = 0$
 $v_0 = 20$

$2 a_y = v_f - v_0$
 $2(-9.8) y = \frac{-(20)^2}{2(-9.8)}$

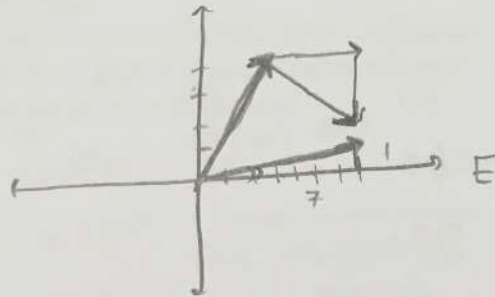
$y = 20t + \frac{1}{2}(-9.8)t^2$
 $2(-9.8) y = - (20)^2 \quad \frac{-400}{19.6}$

9. A second launching vehicle is moving forward at 5m/s and its cannon shoots a shell straight up. The shell moves through the air without friction for 2s. How far, in m, in front of the cannon does the shell land?

- a. 10.
- b. 40.
- c. -10.
- d. 0
- e. 20.

10. A military jet first flies in one direction, turns sharply and then flies in another, as described by the vectors: $A=2i+4j$; $B=5i-3j$. Take the x-axis as east and find the angle in degrees of the sum of these motions relative to east.

- a. 4
- b. 8
- c. 10
- d. 82
- e. 352



$$\begin{matrix} 7, 1 \\ 2 & 4 \\ 5 & -3 \\ \hline 7 & 1 \\ \text{O.P} \end{matrix}$$

11. A car slows down because of traffic and has an acceleration of -1.0 m/s^2 . After moving for 6.0 m, it has a velocity of 4.0 m/s . What was its initial velocity?

- a. 2
- b. 16
- c. 5.3
- d. 15
- e. 3.8

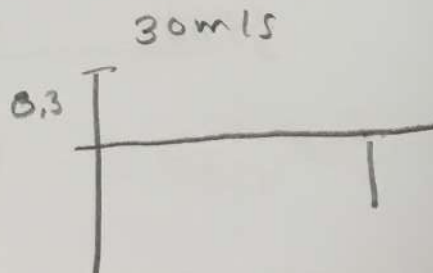
$$2ax = v_2^2 - v_1^2$$

$$2(-1)(6) = 4^2 - v_0^2$$

$$\begin{aligned} a &= -1 \\ d &= 6 \\ v_f &= 4 \\ 4^2 &= x^2 + 2(-1)(6) \\ 4^2 &= x^2 - 12 \\ \frac{16}{+12} & \\ \hline & 28 \end{aligned}$$

12. A car drives off a cliff next to a river at a speed of 30 m/s and lands on the bank on the other side. The road above the cliff is horizontal and 8.3 m above the other shore where the car lands. The tires on the car all hit at once and the air resistance is insignificant. How long is the car in the air?

- a. 1.3
- b. 0.92
- c. 0.76
- d. 0.45
- e. 2.2



$$-8.3 = \frac{1}{2}(-9.8)t^2$$

$$t = 1.3$$

$$\begin{aligned} v_{0x} &= 30 \text{ m/s} \\ t &= 1.3 \end{aligned}$$

$$-8.3 = \frac{1}{2}(-9.8)t^2$$

$$\frac{v - v_i}{a} = t$$

$$v_0 = 0$$

$$v_f$$

$$a = 2 \text{ m/s}^2$$

$$x = v_0 t$$

$$x = 60t$$

$$v_f = 2 \text{ m/s}^2 t$$

$$\frac{v^2}{2(2 \text{ m/s}^2)}$$

$$x = v_0 t$$

velocity → time

velocity no acceleration

13. A speeding car moving at constant speed of 60 m/s passes a policeman who immediately starts his motorcycle (from rest) and accelerates at 2 m/s². How long, in seconds, will it take the policeman to catch up with the car?

- a. 20
- b. 30
- c. 60
- d. 80
- e. 120

$$v = (2)(20)$$

$$60 = 2(30)$$

$$2(60) = 120$$

$$30(60) = 1800$$

$$(60)^2 = 2(2)(x)$$

$$900 = x$$

60 m/s

60

60 v t

$$v_f = at$$

60

60 m/s

$$= \frac{2 \text{ m}}{\text{s}^2} \cdot \text{s}$$

$$\frac{2}{1} \quad \frac{2}{4} \quad \frac{2}{9}$$

2 m/s²

$$\frac{60 \text{ m}}{\text{s}} \cdot \frac{2}{20}$$

| | | | | | | | | |
|---|---|---|----|----|----|-----|-----|-----|
| 2 | 4 | 8 | 16 | 32 | 64 | 128 | 256 | 512 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

14. Another car moving at a constant speed of 60 m/s passes a policeman who starts his motorcycle (from rest) in 10 seconds and then accelerates at 2 m/s². How far, in meters, from the original point will it catch up with the car?

- a. 1700
- b. 2700
- c. 3700
- d. 4700
- e. 5700

$$455$$

$$625$$

$$6873$$

$$v = at$$

$$2ax = v_0^2$$

$$(2)(45)$$

$$90(45) = 4050$$

$$600 \text{ m} \quad 60 \quad 60 \quad 60 \quad 60$$

$$x = v_0 t + \frac{1}{2} at^2$$

$$v_0 t + \frac{1}{2} at^2$$

$$v_0 t + \frac{1}{2} (2) t^2$$

$$= 60(t + 10)$$

$$4t^2 = 60t + 600$$

15. A drone is in level flight at a speed of 201 m/s and an altitude of 802 m. At what horizontal distance, in m, from the target should the remote pilot drop an aid package so it lands on target?

- a. 2570
- b. 375
- c. 890
- d. 1560
- e. 2570

201 m/s

802

$$-802 = -4.9t^2$$

$$1279 = t$$

$$(201)(t)$$

$$x = (201 \text{ m/s}) t$$

$$-802 = (-9.8) t^2$$

$$1279$$

To do
kill yourself

$$y = (32.1 \sin 41.2)t + \frac{1}{2}(-9.8)t^2$$

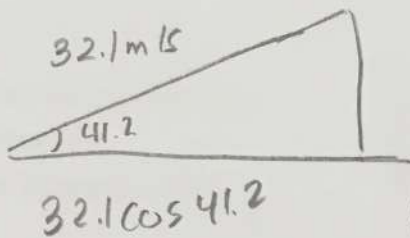
$$32.1 \cos 41.2 (t)$$

Version B

16. A quarterback throws a football at a speed of 32.1 m/s at an angle 41.2 degrees. What horizontal distance in m can he throw it down field if wind and air resistance are insignificant?

- a. 52
- b. 104
- c. 77.3
- d. 42.2
- e. 25.7

$$0 = 32.1 \sin 41.2 t + \frac{1}{2}(-9.8)t^2$$



$$t = 2.07$$

$$x = 32.1 \cos 41.2 (2.07)$$

$$0 = 32.1 \sin 41.2 t + \frac{1}{2}(-9.8)t^2$$

$$t = 4.3$$

$$t = 13.8$$

$$a = -9.8$$

$$v_{0y} = 0$$

$$v_{fy} = 0$$

$$x = v_0 t$$

$$2(-9.8)(-935) = v^2 - 0$$

$$-935 = \frac{1}{2}(-9.8)t^2$$

$$t = 13.8$$

17. A plane in level flight at 98 m/s at an altitude of 935 m drops a package. Find the speed in m/s with which the package lands.

~~a. 940~~

b. 167

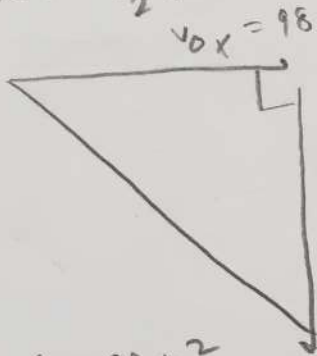
c. 336

~~d. 338~~

e. 233

$$-935 = \frac{1}{2}(-9.8)t^2$$

$$2ay = v^2 - v_0^2$$



98 m/s

$$2(-9.8)(935) = v^2 - v_0^2$$

935 m

$$v^2 = 2(-9.8)(-935)$$

$$v = 135$$

$$x = 0 + (98)(13.8)$$

13.8 seconds

$$v_{0x} = 98 \text{ m/s}$$

135

$$a = -9.8$$

$$v_{0y} = 0$$

$$(-935) + \frac{1}{2}(-9.8)t^2$$

18. A bean fills a volume of 3.0 mm^3 . To compare the size of a bean with a large container, what is the volume of the bean in units of m^3 ?

~~a. 0.003 m^3~~

~~b. 0.027 m^3~~

~~c. $3 \times 10^{-6} \text{ m}^3$~~

d. $3 \times 10^{-9} \text{ m}^3$

~~e. $3 \times 10^9 \text{ m}^3$~~

$$3.0 \text{ mm}^3 \cdot \frac{1000 \text{ mm}}{1 \text{ m}}^3 = \frac{3.0 \text{ mm}^3}{(10)^3 \text{ mm}^3}$$

$$\frac{10 \text{ mm}}{1 \text{ cm}} \cdot \frac{100 \text{ m}}{1 \text{ m}}$$

$$\frac{1 \text{ m}^3}{(100)^3 \text{ cm}^3}$$

3.0

→ 98 m/s

$$-935 = \frac{1}{2}(-9.8)t^2$$

$$2(-9.8)(-935) = v^2 - v_0^2$$

135