**Motion Practice #2: Accelerated Motion!**

As in Motion Practice #1, travelling north from the SHS flagpole will be the positive direction; south will be the negative direction.

**TUTORIAL**: Study the following example before attempting the problems.

0

25

20

**Velocity (m/s)**

**Time (s)**

5

10

15

2

4

6

8

This object moves north, starting at rest and increasing its velocity constantly. It reaches 24 m/s after 8.0 s.

$slope=\frac{∆v}{∆t}$ *→* $a=\frac{∆v}{∆t}$

Taking the **slope** of this line, we divide *change in velocity* by *change in time*, which gives us **acceleration**!

$a=\frac{24 ^{m}/\_{s}}{8.0 s}=3.0\frac{^{m}/\_{s}}{s}=3.0^{m}/\_{s^{2}}$ ← This object gains 3.0 m/s of *speed* **every** second!

The **linear equation** $(y=mx+b)$ is in the form $v=at$ *\*Note: y-intercept is 0!*

Our linear equation for this example is $v=\left(3.0 ^{m}/\_{s^{2}}\right)t$

If the object moved in this way for a total time of 13 s, its final velocity would be:

$v=\left(3.0^{m}/\_{s}\right)(13s)=39^{m}/\_{s}$ ← Wow!

Another example: If you ride your bike with a starting velocity (*v1)* is 4.0 m/s and you accelerate to 10. m/s (final velocity is *v2)* in 3.0 seconds, your graph would be:

 $slope=a=\frac{∆v}{∆t}=\frac{6.0 ^{m}/\_{s}}{3.0 s}=2.0^{m}/\_{s^{2}}$

0

10

**Velocity (m/s)**

**Time (s)**

4

1

2

3

4

Linear Equation is $v\_{2}=at+v\_{1}$

Specifically: $v\_{2}=(2.0^{m}/\_{s^{2}})t+4.0^{m}/\_{s}$

So if our object moved for a total of 11 s:

$$v\_{2}=\left(2.0^{m}/\_{s^{2}}\right)\left(11s\right)+4.0^{m}/\_{s}=26^{m}/\_{s}$$

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***INSTRUCTIONS****: Show your process clearly and include proper units throughout calculations for every problem! Graphs must be done on graph paper and include appropriate quantitative values.*

1. Mal rides his bike towards the north, starting from rest and constantly increasing his velocity to 6.0 m/s in 5.0 seconds.
	1. Create a **quantitative** *v-t­* graph of Mal’s motion
	2. Calculate the **slope** of this graph
	3. Write the **linear equation** for this graph
	4. Calculate what your **final velocity** would be if Mal continued this motion for a total time of 8.0 seconds.
	5. Use the equation $d\_{2}=\frac{1}{2}at^{2}+v\_{1}t+d\_{1} $to calculate Mal’s *displacement* after 8.0 seconds, assuming he started at the flagpole (origin).
2. Kaylee rides her bike to the north, increasing her velocity from 1.0 m/s to 8.0 m/s  in 3.5 seconds:
	1. Create a **quantitative** *v-t­* graph of Kaylee’s motion
	2. Calculate the **slope** of this graph
	3. Write the **linear equation** for this graph
	4. Calculate what Kaylee’s **final velocity** would be if she continued this motion for a total time of 6.0 seconds.
	5. Use the equation given in #1e to calculate Kaylee’s **final *displacement*** after 9.0 seconds, assuming she started 5.0 m south of the flagpole *(Hint:* $d\_{1}=-5.0 m$*)*. Where is she standing in relation to the flagpole?
3. Jayne rides his bike to the south with and initial velocity of 10. m/s and decreases his speed constantly until he comes to a stop after 15 seconds:
	1. Create a **quantitative** *v-t­* graph of Jayne’s motion
	2. Calculate the **slope** of this graph
	3. Use the equation given in #1e to calculate his **final *displacement*** once Jayne has come to a stop, assuming he started 50. m north of the flagpole. Where is Jayne standing in relation to the flagpole?

***INSTRUCTIONS****: Show your process clearly and include proper units throughout calculations for every problem! Graphs must be done on graph paper and include appropriate quantitative values.*

1. Mal rides his bike towards the north, starting from rest and constantly increasing his velocity to 6.0 m/s in 5.0 seconds.
	1. Create a **quantitative** *v-t­* graph of Mal’s motion
	2. Calculate the **slope** of this graph
	3. Write the **linear equation** for this graph
	4. Calculate what your **final velocity** would be if Mal continued this motion for a total time of 8.0 seconds.
	5. Use the equation $d\_{2}=\frac{1}{2}at^{2}+v\_{1}t+d\_{1} $to calculate Mal’s *displacement* after 8.0 seconds, assuming he started at the flagpole (origin).
2. Kaylee rides her bike to the north, increasing her velocity from 1.0 m/s to 8.0 m/s  in 3.5 seconds:
	1. Create a **quantitative** *v-t­* graph of Kaylee’s motion
	2. Calculate the **slope** of this graph
	3. Write the **linear equation** for this graph
	4. Calculate what Kaylee’s **final velocity** would be if she continued this motion for a total time of 6.0 seconds.
	5. Use the equation given in #1e to calculate Kaylee’s **final *displacement*** after 9.0 seconds, assuming she started 5.0 m south of the flagpole *(Hint:* $d\_{1}=-5.0 m$*)*. Where is she standing in relation to the flagpole?
3. Jayne rides his bike to the south with and initial velocity of 10. m/s and decreases his speed constantly until he comes to a stop after 15 seconds:
	1. Create a **quantitative** *v-t­* graph of Jayne’s motion
	2. Calculate the **slope** of this graph
	3. Use the equation given in #1e to calculate his **final *displacement*** once Jayne has come to a stop, assuming he started 50. m north of the flagpole. Where is Jayne standing in relation to the flagpole?