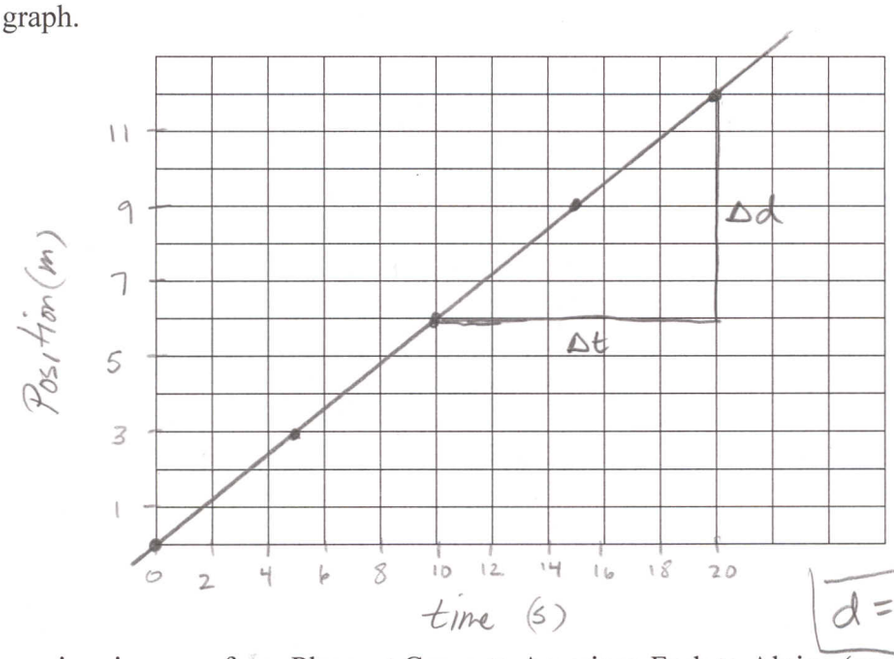
State Exam Review
Standard I

1. Calculate the average velocity of an object from the data below (assume the direction is constant).

Time (s)	Position (m)
0	0
5	3
10	6
15	9
20	12

$\bar{v} = \frac{\text{total displacement}}{\text{total time}} = \frac{12\text{ m}}{20\text{ s}} = 0.6\ \frac{\text{m}}{\text{s}}$

2. From the data above make a graph of position vs. time and write and equation for the object using your graph.



from $y = mx + b$

y = position - d

m = slope which is $\bar{v}$ (constant velocity)

x = time - t

b = initial velocity

$m = \bar{v} = \frac{\Delta d}{\Delta t} = \frac{12\text{m} - 6\text{m}}{20\text{s} - 10\text{s}}$

$= 0.6\ \frac{\text{m}}{\text{s}}$

$d = 0.6\ \frac{\text{m}}{\text{s}} \cdot t$

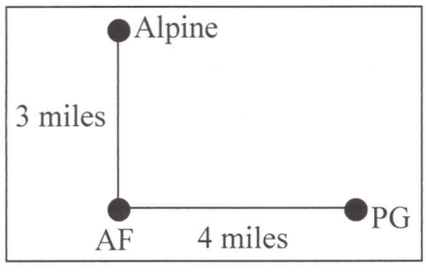
3. A person jogging runs from Pleasant Grove to American Fork to Alpine (see map)
   a. What is the total distance the jogger went to get to Alpine?

      $3 + 4 = 7$ miles

   b. What is the total displacement of the jogger when they get to Alpine?

      $\sqrt{3^2 + 4^2} = 5$ miles

   c. If the jogger turns around and follows the route, what is the total distance and displacement when they return to the starting position?



0 – no change of position

4. A car travels north on State Street at 40 mi/hr.
   a. What is the speed of the car?

      $40 \frac{m.}{hr}$

   b. What is the velocity of the car?

      $40 \frac{m.}{hr}$, North

   c. Is either the speed or velocity constant?

      yes both is the car continues to move in a straight line

5. A race car travels at a constant speed of 240 mi/hr around a one mile oval track.
   a. What is the average speed for the lap?

      $240 \frac{m.}{hr}$

   b. What is the average velocity for the lap?

      0 - no displacement

Data for a falling object

Position (m)	Time (s)
0	0
5	1
20	2
45	3
80	4

6. What is the average velocity from:
   a. t = 0s to t = 1s $\bar{v} = \frac{5m}{1s} = 5 m/s$
   b. t = 0s to t = 3s $\bar{v} = \frac{45m}{3s} = 15 m/s$
   c. t = 3s to t = 4s $\bar{v} = \frac{80-45}{4-3} = \frac{35m}{1s} = 35 m/s$

7. What is the average acceleration for an object in free-fall near the surface of the earth?

   $a = g = 9.8 m/s^2 \approx 10 m/s^2$

8. What is the instantaneous velocity at:
   a. t = 0s $v = gt = 10(0) = 0$
   b. t = 1s $v = gt = 10(1) = 10 m/s$
   c. t = 2s $v = gt = 10(2) = 20 m/s$
   d. t = 3s $30 m/s$
   e. t = 4s $40 m/s$

9. Determine the average acceleration of several objects using the data below.

A	
Time (s)	Velocity (m/s)
0	0
10	5
20	10
30	15

$a = \frac{v_f - v_i}{t} = \frac{15\,m/s - 0}{30\,s} = 0.5\,m/s^2$

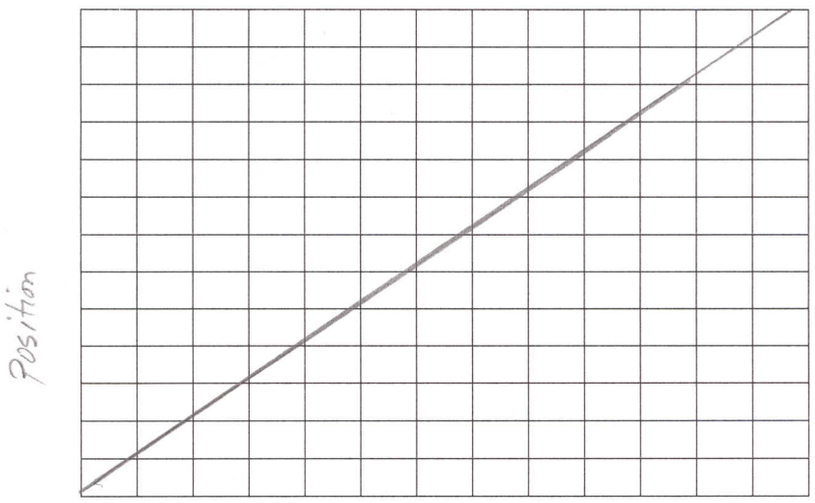
B	
Time (s)	Velocity (m/s)
0	30
10	30
20	30
30	30

$a = 0$
(constant speed)

C	
Time (s)	Velocity (m/s)
0	15
10	20
20	25
30	30

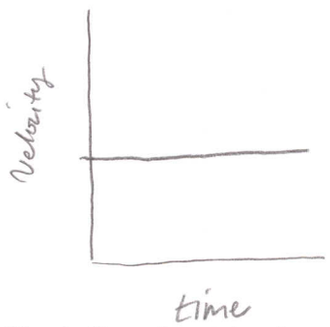
$a = \frac{v_f - v_i}{t} = \frac{30\,m/s - 15\,m/s}{30\,s} = 0.5\,m/s^2$

10. Draw a position-time graph that shows a car moving north on state street when a = 0m/s^2 (North is positive and South is negative.)

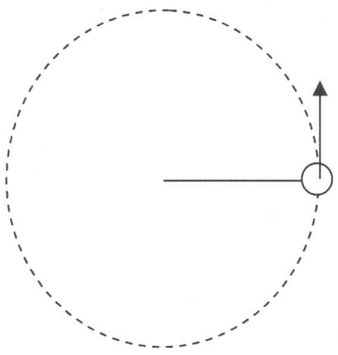


the key for this that there is a constant positive slope

11. Draw a velocity-time graph that shows a car moving north on state street when a = 0m/s^2 (North is positive and South is negative.)



since the slope of this graph is acceleration - it should be zero with a positive y intercept to represent the speed it is going

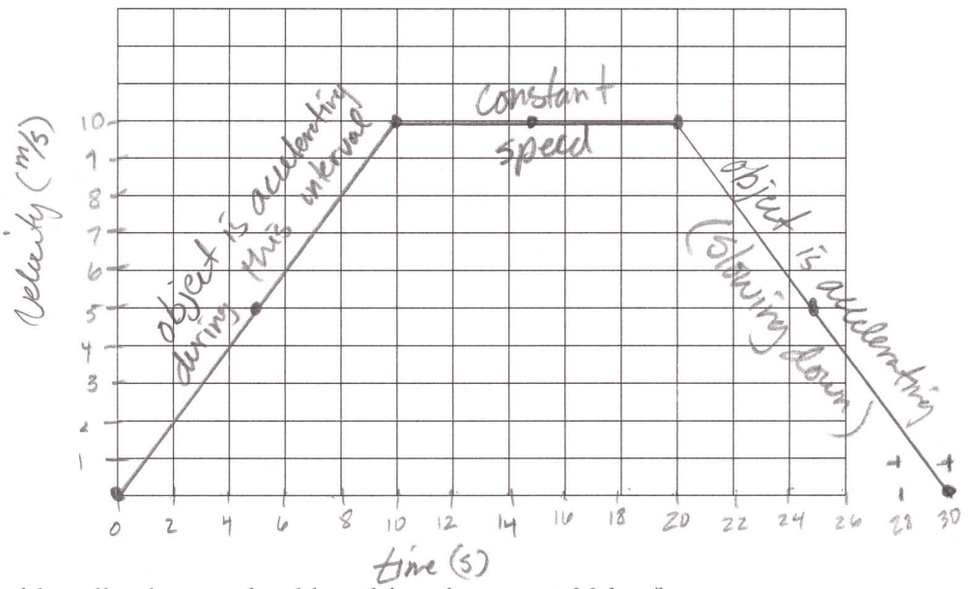


12. The ball on the string is moving at constant speed. Is it velocity constant as well? Explain.

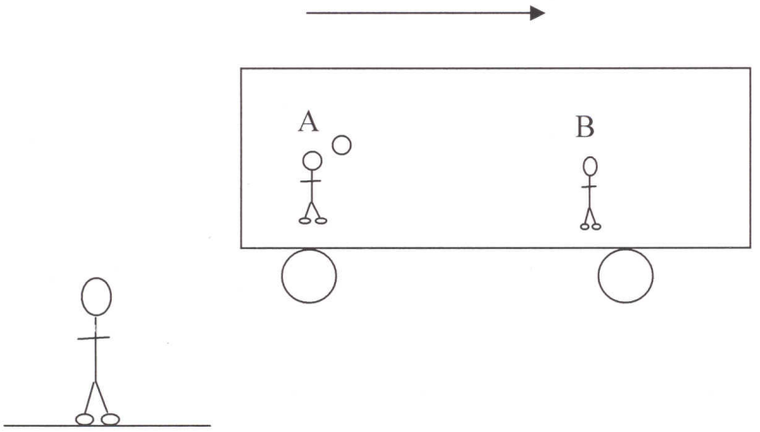
The velocity is changing because the direction is constantly changing

13. Make a velocity-time graph for the following data and describe the motion of the object during each time interval.

Time (s)	Velocity (m/s)
0	0
5	5
10	10
15	10
20	10
25	5
30	0



14. You are standing on the sidewalk when a school bus drives by you at 30 km/hr.



a. If child A is throwing a straight ball up and down, describe the motion of the ball from your viewpoint and from the viewpoints of both children.

child A & B will see the ball go straight up and down
you will see the ball as a projectile

b. If child A throws the ball at 2 km/hr to child B, what is the speed of the ball from your position?

$$v = 30\ \frac{km}{hr} + 2\ \frac{km}{hr} = 32\ \frac{km}{hr}$$

c. If child B throws the ball at 2 km/hr to child A, what is the speed of the ball from your position?

$$v = 30\ \frac{km}{hr} - 2\ \frac{km}{hr} = 28\ \frac{km}{hr}$$

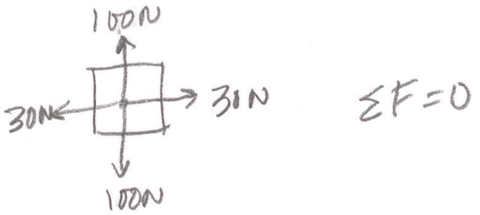
15. In our solar system, where would it be the most simple to observe and plot the paths of the planets?

In a position that is not moving – the sun

16. Describe the motion of any object moving with balanced forces in terms of acceleration.

balanced forces mean no acceleration

17. You push a 100N crate on a level floor with a force of 30N and it does not move. Draw a force diagram of the crate and determine the net force.



$\Sigma F = 0$

18. Draw a force diagram for each situation below. Assume constant or zero velocity.
    a. Car (W = 2000N)
    b. Skydiver (W = 300N)
    c. Person walking on flat ground (W = 300N)

a)

b)

c)