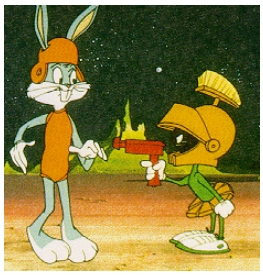
AP Calculus
3.4 Worksheet

All work must be shown in this course for full credit. Unsupported answers may receive NO credit.

1. Boyle's Law states that if the temperature of a gas remains constant, its pressure is inversely proportional to its volume. Show that the rate of change of the pressure is inversely proportional to the square of the volume.

2. Once again trying to blow up earth because it interferes with his view of Venus, Marvin the Martian lands on the moon. Bugs Bunny, as always, interferes with his plan. Chasing Bugs, Marvin fires a warning shot straight up into the air with his Acme Disintegration Pistol. The height (in feet) after t seconds of the shot is given by



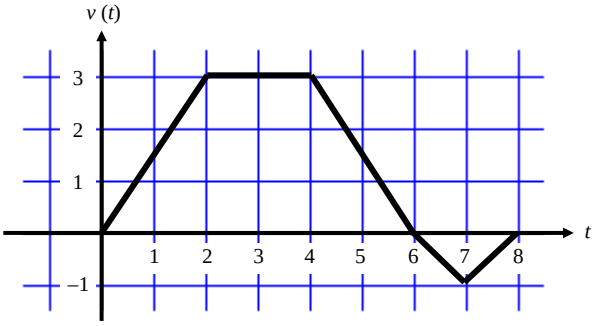
$$s(t) = -2.66t^2 + 135t + 3.$$

a) Find the velocity and acceleration as functions of time.
(What is the meaning of the acceleration function?)

b) How long will it take for Marvin's shot to reach its maximum height?

c) What is the maximum height for Marvin's shot?

3. A bug begins to crawl up a vertical wire at time $t = 0$. The velocity, v, of the bug at time t, $0 \le t \le 8$ is given by the function whose graph is shown below.



At what value of t does the bug change direction?

A) 2 B) 4 C) 6 D) 7 E) 8

4. If the position of a particle on the x – axis at time t is $-5t^2$, then the average velocity of the particle for $0 \le t \le 3$ is

A) –45 B) –30 C) –15 D) –10 E) –5

5. A particle moves along the x – axis so that its position at time t is given by $x(t) = t^2 - 6t + 5$. For what value of t is the velocity of the particle zero?

A) 1 B) 2 C) 3 D) 4 E) 5

6. Rocket *A* has a positive velocity *v* (*t*) after being launched upward from an initial height of 0 feet at time *t* = 0 seconds. The velocity of the rocket is recorded for selected values of *t* over the interval $0 \le t \le 80$ seconds as shown in the table below.

T (sec)	0	10	20	30	40	50	60	70	80
v (*t*) (ft/sec)	5	14	22	29	35	40	44	47	49

a) Find the average acceleration of Rocket *A* over the time interval $0 \le t \le 80$ seconds. Indicate units of measure.

b) Using the data, find an estimate for $v'(35)$. Indicate units of measure.

7. A particle moves along the *x* – axis so that its position at any time $t \ge 0$ is given by the function $x(t) = t^3 - 12t + 1$, where *x* is measured in feet and *t* is measured in seconds.

a) Find the displacement during the first 3 seconds.

b) Find the average velocity during the first 3 seconds.

c) Find the instantaneous velocity when *t* = 3 seconds.

d) Find the acceleration of the particle when *t* = 3 seconds.

e) When is the particle moving left?

f) At what value or values of *t* does the particle change directions?

g) When is the particle speeding up?

8. The cost involved in maintaining annual inventory for a certain manufacturer is given by $C(x) = \frac{1,008,000}{x} + 6.3x$.
Where *x* is the number of items stored. Find the marginal cost of storing the 351^{st} item.

9. Complete the following questions from the textbook: pages 135 – 140 #2 – 5, 8 – 13, 18, 19, 23, 25, 27, 37