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(C1) Kinematics with Calculus Worksheet

1. The velocity of a bullet as it travels down the barrel of a rifle toward the opening is given by:

$$\mathbf{V}(t) = (-5 \times 10^7 \text{ m/s}^3)\,\mathbf{t}^2 + (3 \times 10^5 \text{ m/s}^2)\,\mathbf{t}$$

… where **v** is in meters per second and **t** is in seconds. The acceleration of the bullet just as it leaves the barrel is zero.

a) Determine an expression for the position of the bullet as a function of time while the bullet is in the barrel.

b) Determine an expression for the acceleration of the bullet as a function of time while the bullet is in the barrel.

c) Determine the time interval over which the bullet is accelerated

d) Find the velocity at which the bullet leaves the barrel

e) Find the length of the barrel

2. A toy car has the velocity expression $\mathbf{v}(t) = (1 \text{ m/s}^3)\,\mathbf{t}^2 + 1 \text{ m/s}$. What will be the car's displacement from 0 s to 2 s?

3. A particle's acceleration in a straight line is modeled by the expression $\mathbf{a}(t) = (5\text{m/s}^3)\,\mathbf{t}$. At t = 2s its velocity is recorded as +17 m/s. What is the particle's velocity at a time of 4 seconds?

4. Turn the x(t) expression below into its corresponding v(t) and a(t) expressions.

$$\mathbf{x}(t) = \sin(2\mathbf{t}) + \cos(\mathbf{t})$$