

Extra Problems

1. Find the antiderivative of $(x + 1)(3x - 2)$ that has the value 5 when $x = 0$.
2. Find $f(x)$ satisfying $\frac{df}{dx} = x^4 - 2x^3 + 1$ and $f(1) = 0$.
3. Find $x(t)$ satisfying $\frac{d^2x}{dt^2} = 2t^2 - 3t + 1$ and $x(0) = 0$ and $x'(0) = 6$.
4. You're driving down the road at 40 mi/h and up ahead there's an intersection where the light has just turned yellow. You really want to make the light, so you step on the gas which accelerates the car according to the function $a(t) = t$ mi/h². If you're 0.01 miles from the light when it turns yellow, and it stays yellow for 3 seconds, will you reach the intersection by the time it turns red?
5. A viscous fluid fills the space between two flat plates separated by a distance D . The lower plate is held fixed while the upper plate is moved to the right at a constant velocity v_0 . The motion of the plate causes the fluid to move, but the velocity of the fluid as we travel vertically downward towards the bottom plate is not constant. Instead, the differential equation

$$\frac{dv}{dy} = \frac{v_0}{D}$$

describes this change in velocity v with respect to the vertical position y . Find the velocity $v(y)$ of the fluid as a function of y , and sketch a diagram of the plates, the fluid, and your solution for the flow field.