Problem 1. Find the general solutions for the following differential equations

a) $\dfrac{dy}{dx} = \dfrac{3}{x^2} - 2x^2$

b) $\dfrac{dy}{dx} = \dfrac{1+2x}{x}$

c) $\dfrac{dy}{dx} = \dfrac{1}{1+2x}$

d) $\dfrac{dy}{dx} = sec^2(3x - 1)$

e) $\dfrac{dy}{dx} = \dfrac{1}{x\ln(2x)}$ [Hint: consider $\dfrac{dy}{dx}\ln(\ln(x))$.]

Problem 2. Solve the initial value problem that models the growth of a population with time:
$$\frac{dN}{dt} = t$$
where $N(0) = 20$.

Problem 3. Solve the initial value problem
$$\frac{dy}{dx} = -2x^2 + 3$$
where $y(3) = 10$.

Problem 4. An object moves with a constant acceleration of 12 m/s^2. Find the how far the object has fallen after 2 seconds if the object has the initial velocity $v(0) = 4$ m/s and initial displacement of $d(0) = 2$ m.