

# 1.4 Exercises

**Problem 1** Find explicit particular solutions for the initial value problem:

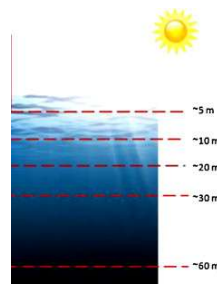
$$\frac{dy}{dx} = 2xy^2 + 3x^2y^2, \text{ with init. cond. } y(1) = -1.$$

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## Underwater Light Intensity

**Problem 2** Natural (Exponential) Growth and Decay:  $\frac{dy}{dx} = ky$ , where  $k$  is a constant.

The intensity  $I$  of light at a depth of  $x$  meters below the surface of a lake satisfies the differential equation:  $\frac{dI}{dx} = -1.4I$ .



**Part a.** At what depth is the light intensity  $I$  half of the surface light intensity  $I_0 := I(0)$ ?

**Part b.** What is the intensity at a depth of 10 m (in terms of  $I_0$ )?  $I(x) = I_0 e^{-1.4x}$

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### Population Growth

**Problem 3** For a population of kangaroos, assume that 10% of kangaroos become pregnant every year and have, on average, two joeys (babies) per litter. Also assume that 10% of kangaroos die annually.



a) Given an exponential growth model, what is the DEQ which describes the population?

b) What is the general solution?

c) If you know that in 2011 there were 34 million kangaroos, how many kangaroos are predicted by this model this year?

