

1. Consider the ODE  $y' = y^2$ .

This ODE is...

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- (B) Linear but not separable.
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**Follow-up.** Solve it!

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3. Consider the ODE  $y' = xy + x + y + 1$ .

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A simple version of *Newton's law of cooling* says that, if an object of temperature  $T$  is placed in an environment of constant ambient temperature  $A$ , then  $dT/dt$  is proportional to  $A - T$ .

4. True or False?

$$\lim_{t \rightarrow \infty} T = A.$$

5. True or False?

Suppose  $p$  is some function of  $x$  and consider the ODE

$$y' + p(x)y = 0.$$

If  $f$  is a solution to this ODE, then so is  $cf$  for any constant  $c$ .



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**Follow-up.** Is the set of all solutions of this ODE a vector space?

6. True or False?

There exists a unique continuous function  $f : [0, \infty) \rightarrow \mathbb{R}$  such that  $f$  is differentiable for all  $x > 0$ ,  $f(0) = 0$ , and

$$f' = f^{1/3}.$$

The velocity  $v$  of an object of mass  $m$  in free fall, subject to air resistance, satisfies the differential equation

$$\frac{dv}{dt} = g - \frac{bv}{m},$$

where  $g = 9.8 \text{ m/s}^2$  is gravitational acceleration and  $b > 0$  is a constant (with units  $\text{kg/s}$ ) that depends on the density of air and the shape of the object.

7. True or False?

$$\lim_{t \rightarrow \infty} v = \frac{gm}{b}.$$