

Exercise 1.3-1.7

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December 15, 2014

Find the differential equations corresponding to the following primitives.

Exercise (1.3).

$$y = cx + \sqrt{1 - c^2}.$$

Solve.

$$y' = x.$$

□

Exercise (1.4).

$$(x - c_1)^2 + (y - c_2)^2 = r^2.$$

Solve.

$$(x - c_1) + (y - c_2) \frac{dy}{dx} = 0.$$

$$1 + \left(\frac{dy}{dx}\right)^2 + (y - c_2) \frac{d^2y}{dx^2} = 0.$$

$$2 \left(\frac{dy}{dx}\right) \frac{d^2y}{dx^2} + \frac{d^2y}{dx^2} + (y - c_2) \frac{d^3y}{dx^3} = 0.$$

So

$$-\frac{d^3y}{dx^3} - \frac{d^3y}{dx^3} \left(\frac{dy}{dx}\right)^2 + 2 \left(\frac{dy}{dx}\right) \left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{d^2y}{dx^2}\right)^2 = 0.$$

□

Exercise (1.5).

$$y = c_1 x^2 + c_2.$$

Solve.

$$y' = 2c_1 x, y'' = 2c_1.$$

So $y' = y'' x$.

□

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Exercise (1.6).

$$y^2 + c_1x = 0.$$

Solve.

$$2yy' + c_1 = 0,$$

So

$$y^2 - 2yy'x = 0.$$

□

Exercise (1.7).

$$x^2 = 2cy + c^2.$$

Solve.

$$2x = 2cy',$$

So

$$x^2y'^2 = 2cy'yy' + c^2y'^2 = 2xyy' + x^2.$$

□