1. (diffeq:sep1)
   Find a solution to the initial value problem
   $$\begin{aligned} \frac{dy}{dx} &= e^y x^3 \\ y(0) &= 0 \end{aligned}$$

2. (diffeq:sep2)
   Find a solution to the initial value problem
   $$\begin{aligned} \frac{dy}{dx} &= (1+y^2)e^x \\ y(0) &= 0 \end{aligned}$$

3. (diffeq:sep3)
   Find a solution to the initial value problem
   $$\begin{aligned} \frac{dy}{dx} &= y\sqrt{y^2-1}\cos(x) \\ y(0) &= 1 \end{aligned}$$

4. (diffeq:sep4)
   Find the general solution to the differential equation
   $$\frac{dy}{dx} = x^2 + y^2x^2$$

5. (diffeq:sep5)
   Find the general solution to the differential equation
   $$\frac{dy}{dx} = \frac{1}{e^y\sqrt{1-x^2}}$$

6. (diffeq:sep6)
   Find the general solution to the differential equation
   $$\frac{dy}{dx} = \frac{1}{e^y(1+x^2)}$$

7. (diffeq:sep7)
   Find a solution to the initial value problem
   $$\begin{aligned} \frac{dy}{dx} &= \sqrt{1-y^2}\sec^2(x) \\ y(0) &= 0 \end{aligned}$$

8. (diffeq:fol1)
Find the general solution to the differential equation (for $x \neq 0$)

$$x\frac{dy}{dx} = -y + x$$

9. (diffeq:fol2)
Find the general solution to the differential equation

$$\frac{1}{2x}\frac{dy}{dx} = y + e^{x^2}$$

10. (diffeq:fol3)
Find a solution to the initial value problem

$$x\frac{dy}{dx} + 2y = \frac{\cos(x)}{x}$$
$$y(\pi) = 1$$

11. (diffeq:fol4)
Find a solution to the initial value problem

$$\cos(x)\frac{dy}{dx} = 1 - \sin(x)y$$
$$y(0) = 1$$

12. (diffeq:fol5)
Find a solution to the initial value problem

$$x\frac{dy}{dx} + 2y = -\frac{\sin(x)}{x}$$
$$y(\frac{\pi}{2}) = 1$$

13. (diffeq:twoBranches)
Find a solution to the initial value problem

$$\frac{dy}{dx} = (y-1)\frac{1}{x}$$
$$y(-1) = 0$$

14. (diffeq:fol6)
Find the general solution to the differential equation

$$\cos(x)\frac{dy}{dx} = y + \sin(x) + 1$$

where we assume that $\frac{-\pi}{2} < x < \frac{\pi}{2}$.

15. (diffeq:fol7)
Find the general solution to the differential equation

$$\frac{dy}{dx} + \frac{1}{x^2 - 1}y = \frac{3}{2}\sqrt{1 + x}$$

where we assume that $x > 1$.

16. (diffeq:fol8)
Find a solution to the initial value problem

$$x^2\frac{dy}{dx} - 2xy = x^4\cos(x)$$
$$y(\pi) = 1$$

17. (diffeq:fol9)
Find a solution to the initial value problem

$$(1 + x^2)\arctan(x)\frac{dy}{dx} = (1 + x^2)e^x - y$$
$$y(\tan(1)) = e^{\tan(1)}$$

18. (diffeq:fol10)
Find a particular solution to the differential equation

$$\frac{1 + x^3}{3x^2}\frac{dy}{dx} = 1 - y(x)$$
$$y(1) = 2$$