

## Separable Differential Equations

1.  $y = \pm\sqrt{x^2 + C}$
2.  $y = \pm\sqrt{e^{2C}x^2 - 9}$
3.  $y = \arcsin(C - \cos x)$
4.  $y = 3\tan(3x + C)$
5.  $y = \tan(\arctan x + C)$
6.  $y = \frac{1}{3}\ln\left(\frac{3}{2}e^{2x} + C\right)$
7.  $y = \pm\sqrt{8 + x^2}$
8.  $y = 3e^{x^2} - 1$
9.  $y = \tan\left(\frac{1}{2}x^2 - \arctan 2\right)$
10.  $y = \pm\sqrt{\left(2x^{\frac{3}{2}} + C\right)^2 - 9}$
11.  $y = Ce^{\frac{1}{2}x^2} + 4$
12.  $y = Ce^{\frac{1}{2}x^2 - 2x} + 3$
13.  $y = Cx$
14.  $y = \tan(\arctan x + C)$
15.  $y = \ln|x + C|$
16.  $y = \pm\frac{1}{\sqrt{-3x^2 - C}}$
17.  $y = \tan(C - x^3)$
18.  $y = \frac{100e^{200x}}{e^{200x} + C}$
19.  $y = -\frac{1}{\cos x - 3x + C}$
20.  $y = \arcsin Ce^x$
21.  $y = \frac{4}{3 - Ce^{8x^3 + 16x}}$
22.  $y + \frac{1}{y} = 2x^2 + C$
23.  $y = \ln(e^{Cx} - 1)$
24.  $2y + \frac{2}{3}y^2 = 2x + \frac{2}{3}x^{\frac{3}{2}} + C$
25.  $y = -\frac{Ce^{2x^3} + 1}{Ce^{2x^3} - 1}$
26.  $y = x + 1$
27.  $y = \sqrt{1 - x^2}$
28.  $y = -\frac{2Ce^{4x} + 2}{1 - Ce^{4x}}$
29.  $y = ex^{2x^2 + 1}$
30.  $y = \pm\sqrt{Ce^{x^2} - 1}$

## First Order Linear Differential Equations

a.  $y(x) = Ce^{e^{4x}} - 4x - 1$

b.  $y = Ce^{-2x} + 4e^{3x}$

c.  $y = Ce^{4x} + 4x + 1$

d.  $y = Ce^{x^2} - \frac{1}{2}$

e.  $y = 2x^2 + Cx^{-3}$

f.  $y = Cx^{-2} - \frac{\cos x}{x^2}$

g.  $y = Cx^3 - \frac{2}{5}\sqrt{x}$

h.  $y = C \cos x + x \cos x$

i.  $y = \frac{Ce^{-5x} + 4}{x^2}$

j.  $y = Ce^{-\sqrt{x}} + \frac{2}{3}x^{\frac{3}{2}}e^{-\sqrt{x}}$

a.  $y(x) = 7e^{e^{3x}} - 2$

b.  $y(x) = -2$

c.  $y = \frac{1}{2}e^{-3x} - \frac{1}{2}e^{-5x}$

d.  $y = \frac{10}{27}e^{-\frac{3}{2}x} \left( 17e^{\frac{3}{2}} + 16e^{\frac{3}{2}x} - 24xe^{\frac{3}{2}x} + 18x^2e^{\frac{3}{2}x} \right)$

e.  $y = x \sin x - x$

f.  $y = \frac{4\sqrt{5}}{\sqrt{x^2 + 1}} + x^2$

## Exact Differential Equations

a.  $xy^2 + x^2y = C$

b.  $x^2y^3 + x^4 = C$

c.  $2x - x^2 - y^3 = C$

d.  $x^3y^2 + x + 3y^2 = C$

e.  $x^4y - \frac{1}{5}y^5 = C$

f.  $x + x \ln xy - x = C$

g.  $x + xe^y = C$

h.  $xe^y + y = C$

## Homogeneous Linear Differential Equations

**a.**  $x \ln x + Cx$

**b.**  $y = x \tan(\ln x + C)$

**c.**  $y = x \tan(C - x)$

**1.** see **a.**

**2.**  $y = \frac{x}{\ln x + 1}$

**3.**  $y = Cx^3 - x$

**Solve the following Bernoulli equations.**

a.  $y(t) = \left(1 + \frac{C}{t^3}\right)^{\frac{1}{3}}$

e.  $e^{\frac{t}{y}} = Cy$

b.  $y(t) = -\frac{2e^t}{e^{2t} - 2C}$

f.  $y(t) = \frac{1}{(1 + e^{3C} + t^2 e^{3C})^{\frac{1}{3}}}$

c.  $y(t) = \left(t + Ce^{3t} + \frac{1}{3}\right)^{-\frac{1}{3}}$

g.  $y(t) = \left(-\frac{9}{5t} + \frac{49}{5t^6}\right)^{-\frac{1}{3}}$

d.  $y(t) = -\frac{te^t}{te^t - e^t - C}$

h.  $y(t) = \left(7e^{-\frac{3}{2}t} + 1\right)^{\frac{2}{3}}$