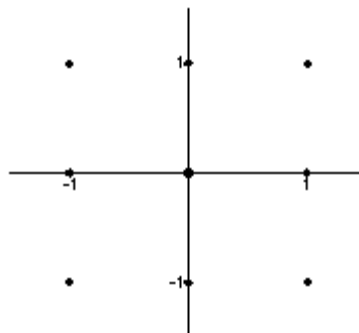


**No calculators**

Use the differential equation  $\frac{dy}{dx} = \frac{y^2}{x^3}$

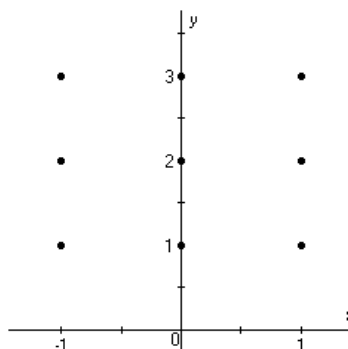
1. On the graph shown at the right, sketch a slope field for the differential equation at the indicated points.



2. Solve the differential equation given the initial condition  $y(1) = 2$
3. Use Euler's Method to approximate  $y(1.5)$  given  $y(1) = 2$  and  $\Delta x = 0.1$ . Be sure to include your calculations in a table.

Use the differential equation  $\frac{dy}{dx} = 2xy$  to answer the following.

4. On the graph shown at the right, sketch a slope field for the differential equation at the indicated points.



5. Use Euler's Method to approximate  $y(1)$  given  $y(0) = 1$  and  $\Delta x = 0.5$ . Be sure to include your calculations in a table.

6. Find the exact value for  $y(1)$  given  $y(0) = 1$ .

7. Suppose  $\frac{dP}{dt} = 0.36P\left(1 - \frac{P}{1200}\right)$  and  $P(0) = 200$ . Find  $P(t)$ .

8. Solve the differential equation  $\frac{dy}{dx} = 3y(y-1)$  if  $y(0) = 1/4$ .

9. The growth rate of a population  $P$  of bears in a newly established wildlife preserve is modeled by the differential equation  $\frac{dP}{dt} = 0.008P(100 - P)$ , where  $t$  is measure in years.

- a.) What is the carrying capacity for bears in this wildlife preserve?
- b.) Find an equation for the population of bears.

10. A 2000-gallon tank can support no more than 150 guppies. Six guppies are introduced into the tank. Assume that the rate of growth of the population is  $\frac{dP}{dt} = 0.0015P(150 - P)$  where time is in weeks.
- a.) Find a formula for the guppy population in terms of  $t$ .
- b.) How long will it take the guppy population to be 100? 125?

11.  $\int x^2 \ln x \, dx$

12.  $\int x \sin(2x) \, dx$

13.  $\int x \sec^2 x \, dx$

14.  $\int \frac{x+4}{(x-1)(x+6)} \, dx$

15.  $\int \frac{2x-1}{(x-1)^2} \, dx$

16.  $\int \frac{1}{x^3 + x^2 - 2x} \, dx$

17.  $\int_{-\infty}^{\infty} \frac{dx}{1+x^2}$

18.  $\int_1^{\infty} \frac{2dx}{x^3}$

19.  $\int_0^1 \frac{dx}{(x-1)^{2/3}}$

20.  $\int \sin^4 x \, dx$

21.  $\int_{\pi/2}^{3\pi/4} \sin^5 x \cos^2 x \, dx$

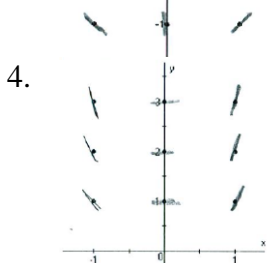
22.  $\int \tan^3 x \sec x \, dx$

**Answers:**



2.  $y = 2x^2$

3.  $y(1.5) \approx 4.316$



5.  $y(1) \approx 1.5$

6.  $y = e^{x^2}$   
And  
 $y(1) = e^1$

7.  $P(t) = \frac{1200}{1+5e^{-.36t}}$

8.  $y(x) = \frac{1}{1+3e^{3x}}$

9. a.)  $A=100$   
b.)  $P(t) = \frac{100}{1 - \frac{1}{C}e^{-.8t}} = \frac{100C}{C - e^{-.8t}}$

10. a.)  $P(t) = \frac{150}{1+24e^{-.225t}}$

11.  $\frac{1}{3}x^3 \ln x - \frac{1}{9}x^3 + C$

12.  $-\frac{1}{2}x \cos(2x) + \frac{1}{4} \sin(2x) + C$

b.)  $P(17.2 \text{ days}) = 100$

$P(21.3 \text{ days}) = 125$

13.  $x \tan x - \ln|\sec x| + C$

14.  $\frac{5}{7} \ln|x-1| + \frac{2}{7} \ln|x+6| + C$

15.  $2 \ln|x-1| - \frac{1}{x-1} + C$

16.  $-\frac{1}{2} \ln|x| + \frac{1}{3} \ln|x-1| + \frac{1}{6} \ln|x+2| + C$

17.  $\pi$     18. 1    19. 3

20.  $-\frac{1}{4} \cos^3 x \sin x - \frac{3}{8} \sin x \cos x + \frac{3}{4} x + C$

21.  $-\frac{1}{3} \cos^3 x + \frac{2}{5} \cos^5 x - \frac{1}{7} \cos^7 x + C$

22.  $\sec x - \frac{1}{3} \sec^3 x + C$