**WORKSHEET XXII**

Separable Differential equations,

1st order Linear Differential Equations,

and Direction Fields



***I*** Solve each of the following separable differential equations.

1. dy/dx = y(1 – y)
2. x dy/dx = 2(y – 4)
3. 

4. 

5. dy/dx = (x+y)/x (*Hint:* Let v = y/x.)

6. 

7. (1 + x2) dy/dx = arctan x

8. 

9. xyy′ = (x+a)(y+b) where *a* and *b* are constants.

10. 

11. where *L* and *R* are constants.

12.  (*Hint:* Let v = y/x.)

13. dP/dt = cP( 1 – P/K) (*the logistic equation*)

***II*** Solve each of the following initial value problems.

1. dy/dx = 6y2x, y(1) = 1/25
2. 
3. 
4. dy/dx = ey(2x – 4), y(5) = 0
5. 

***III*** By selecting an appropriate integrating factor, solve each of the following first-order linear differential equations:

1. x(dy/x) + y = x3, x > 0
2. x(dy/dx) + y = ex, x > 0
3. ex(dy/dx) + 2 ex y = 1
4. x(dy/dx) + 3y = (sin x)/x2, x > 0
5. dy/dx + (tan x) y = cos2 x, -/2 < x < /2
6. x(dy/dx) + 2y = 1 – 1/x, x > 0
7. (t – 1)3(ds/dt) + 4(t – 1)2s = t + 1, t > 1

***IV*** Draw *isoclines* and *direction fields* for each of the following equations. Sketch some of the *integral curves*.

1. dy/dx = x2 – y
2. dy/dx = – x2
3. dy/dx = x – 2y
4. dy/dx = 1/y
5. dy/dx = xy

*Often there is little resemblance between a differential equation and its solution. Who would suppose that an expression as simple as dy/dx = 1/(a2-x2) could be transformed into y = (1/2a) ln (a+x)/(a-x) + C ? This resembles the transformation of a chrysalis into a butterfly!*

- Silvanus P. Thompson

 [Course Home Page](http://www.math.luc.edu/~ajs/courses/162spring2013/index.pdf)          [Department Home Page](http://www.math.luc.edu/)        [Loyola Home Page](http://www.luc.edu/)