

## Handout N

1. Solve the following differential equations for  $y(x)$ .

(a)  $y'' - 9y' = 0$

(b)  $y'' - 9y = 0$

(c)  $y'' + 9y = 0$

(d)  $y'' - 9 = 0$

(e)  $y'' - 2y' - y = 0$

(f)  $y'' - 2y' + 2y = 0$

2. Suppose that  $x'' + bx' + cx = 0$  is used to model the position of a block at the end of a vibrating spring.

(a) What can you say about the signs of  $b$  and  $c$ ? Explain.

(b) As long as friction plays a role, we expect that regardless of the initial conditions  $\lim_{t \rightarrow \infty} x(t) = 0$ . Explain how your answer to part (a) guarantees this.

Hint: it is necessary to do three different cases.

3. Write a differential equation of the form  $x'' + bx' + cx = 0$  such that if  $x(0) = 1$  and  $x'(0) = 2$  then  $x(t)$  has the property that

(a)  $\lim_{t \rightarrow \infty} x(t) = 0$

(b)  $\lim_{t \rightarrow \infty} x(t) = \infty$

(c)  $\lim_{t \rightarrow \infty} x(t)$  does not exist.

Note: there are not unique answers to these problems!