1. a. For $x^3 = 5$ with $x_0 = 1$, then $x_1 = 2.333333$, $x_2 = 1.861678$, $x_3 = 1.722002$, with the actual solution being $x = 1.709976$, which requires 5 Newton iterates for this accuracy.

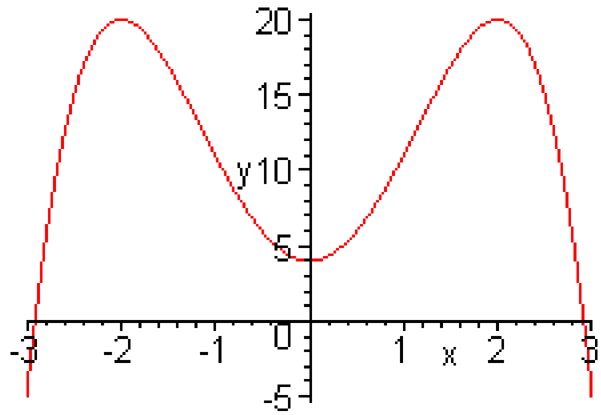
b. For $x^4 = 13$ with $x_0 = 1$, then $x_1 = 4$, $x_2 = 3.050781$, $x_3 = 2.402545$, with the actual solution being $x = 1.898829$, which requires 7 Newton iterates for this accuracy.

2. a. For $f(x) = 4 + 8x^2 - x^4$, $f'(x) = 16x - 4x^3$ and $f''(x) = 16 - 12x^2$.

b. The $y$-intercept is $(0, 4)$, which is also a relative minimum. The two relative maxima are $(\pm 2, 20)$. The points of inflection are $(\pm 2/\sqrt{3}, 116/9) \simeq (\pm 1.15470, 12.8889)$

c. This is an even function, and its graph is below.

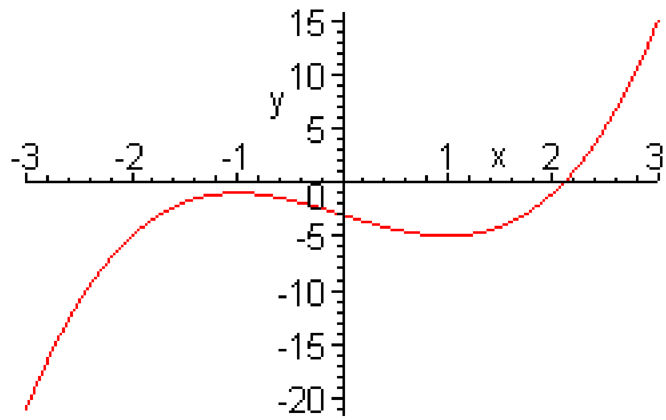
d. From Newton's Method starting with $x_0 = 3$, we approximate the $x$-intercept with $x_1 = 2.916667$ and $x_2 = 2.910723$, with the actual intercept being $x = 2.910693$, which requires 3 Newton iterates for this accuracy.




3. a. For $f(x) = x^3 - 3x - 3$, there is a maximum at $(-1, -1)$, a minimum at $(1, -5)$, and a point of inflection at $(0, -3)$.

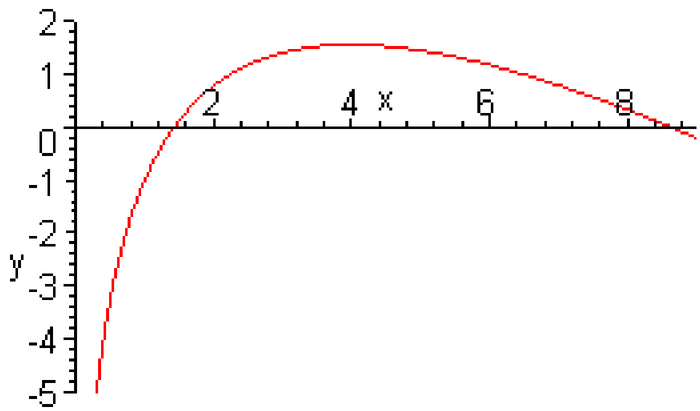
b. This function has no symmetry, and its the graph is below.

c. From Newton's Method starting with $x_0 = 2$, we approximate the $x$-intercept with $x_1 = 2.111111$ and $x_2 = 2.103836$, with the actual intercept being $x = 2.103803$, which requires 3 Newton iterates for this accuracy.



4. a. For $f(x) = 4\ln(x) - x$, $f'(x) = \frac{4}{x} - 1$. There is a maximum at $(4, 4\ln(4) - 4) \simeq (4, 1.5452)$. The domain is for $x > 0$, and the graph is below.

b. From Newton's Method starting with $x_0 = 1$, we approximate the $x$-intercept with $x_1 = 1.333333$ and $x_2 = 1.424636$, with the actual intercept being $x = 1.429612$, which requires 4 Newton iterates for this accuracy. Starting with $x_0 = 8$, we approximate the other $x$-intercept with $x_1 = 8.635532$ and $x_2 = 8.613194$, with the actual intercept being $x = 8.613169$, which requires 3 Newton iterates for this accuracy.




5. a. The velocity of the spring is $v(t) = y'(t) = -4e^{-0.2t}(\sin(2t) + 0.1\cos(2t))$.

b. Note that $v'(t) = 0.08e^{-0.2t}(20\sin(2t) - 99\cos(2t))$, and Newton's formula is

$$t_{n+1} = t_n - v(t_n)/v'(t_n).$$

With $t_0 = 1$, the Newton iterates are $t_1 = 1.730563$ and $t_2 = 1.497363$, with $y(t_2) = -1.46646$. The actual minimum is $(t, y) = (1.52096, -1.46812)$.