Problem 1. For the following functions, use the first derivative test to find: (a) the intervals where the function is increasing and where it is decreasing, and (b) the relative maximum and minimum values.

1. $y = 8 - 2x - x^2$.
2. $y = -x^3 + 6x^2 - 9x - 5$.
3. $y = (x + 1)^3$.
4. $y = x^4 + \frac{4}{3}x^3$.
5. $y = x - \sqrt{x}$.
6. $y = x^2(4 - x^2)$.
7. $y = \dfrac{4x}{x + 4}$.
8. $y = \dfrac{1 - x}{1 + x}$.

Problem 2. Find the intervals of concavity and inflection points for the functions in problem 1.

Problem 3. Use the second derivative test to find the relative maximum and minimum values for the functions in problem 1.

Answers to problem 1.

#	Intervals where increasing	Intervals where decreasing	Max/Min values
1.	$(-\infty, -1)$	$(-1, \infty)$	9 (max) No min
2.	$(1, 3)$	$(-\infty, 1) \cup (3, \infty)$	-5 (max) -9 (min)
3.	$(-\infty, \infty)$	None	No max No min
4.	$(-1, \infty)$	$(-\infty, -1)$	No max $-1/3$ (min)
5.	$(1/4, \infty)$	$(0, 1/4)$	No max $-1/4$ (min)
6.	$(-\infty, -\sqrt{2}) \cup (0, \sqrt{2})$	$(-\sqrt{2}, 0) \cup (\sqrt{2}, \infty)$	4 (max) 0 (min)
7.	$(-\infty, \infty)$	None	No max No min
8.	None	$(-\infty, \infty)$	No max No min

Answers to problem 2.

#	Intervals where concave up	Intervals where concave down	Inflection points
1.	None	$(-\infty, \infty)$	None
2.	$(-\infty, 2)$	$(2, \infty)$	$x = 2$
3.	$(-1, \infty)$	$(-\infty, -1)$	$x = -1$
4.	$(-\infty, -2/3) \cup (0, \infty)$	$(-2/3, 0)$	$x = 0, -2/3$
5.	$(-\infty, \infty)$	None	None
6.	$(-\sqrt{2/3}, \sqrt{2/3})$	$(-\infty, -\sqrt{2/3}) \cup (\sqrt{2/3}, \infty)$	$x = \pm\sqrt{2/3}$
7.	$(-\infty, -4)$	$(-4, \infty)$	$x = -4$
8.	$(-1, \infty)$	$(-\infty, -1)$	$x = -1$

Answers to problem 3. Same as problem 1.