## Critical Points

Find all the critical points of the following functions.

1. $f(y)=(12-2 y)^{4}\left(y^{2}-3\right)^{2}$
2. $G(z)=\left(3 z^{2}+1\right) \sqrt[3]{7-z^{2}}$
3. $Q(t)=-3 t^{4}+12 t^{3}+72 t^{2}+8$
4. $A(t)=5 t-7 \sin (3 t)+6$
5. $h(x)=\mathbf{e}^{x^{2}-5}+3 \mathrm{e}^{-4 x^{2}}$

## Minimum and Maximum Values

6. Below is the graph of some function. Identify the relative and absolute extrema of the function.


## Finding Absolute Extrema

For problems 7 \& 8 find the absolute extrema of the function on the given interval.
7. $f(y)=(12-2 y)^{4}\left(y^{2}-3\right)^{2}$ on [1, 4]
8. $Q(t)=-3 t^{4}+12 t^{3}+72 t^{2}+8$ on $[-4,-1]$

For problems 9-11 if you need to use decimals for any problem use at least 4 decimal places. Also, please take advantage of any work you've done previous in this homework set to make your life easier.
9. The amount of money in an investment account (in thousands) is given by,

$$
A(t)=5 t-7 \sin (3 t)+6
$$

where $t$ is in months. If the amount of money every rises above $\$ 20,000$ the manager of the account will receive a bonus. During the first 3 months the account is open does the account manager receive a bonus?
10. The population of deer in a wildlife park (in hundreds) is given by,

$$
P(t)=250+8 t-50 \ln \left(t^{2}+6\right)
$$

where $t$ is in years. In the first 15 years what is the minimum and maximum population of deer?
11. In order for a chemical process to continue the amount of a one of the component chemicals cannot rise above 500 grams. If the amount of this chemical at any time ( $t$ is in hours) is given by,

$$
Q(t)=-3 t^{4}+12 t^{3}+72 t^{2}+8
$$

will the chemical process ever stop during the first 5 hours?

## The Shape of a Graph, Part I

For problems 12 \& 13 find the intervals in which the function is increasing and decreasing. Also, find and classify all the critical points of the function. If you need to use decimals for any problem use at least 4 decimal places.
12. $h(x)=\mathbf{e}^{x^{2}-5}+3 \mathbf{e}^{-4 x^{2}}$
13. $f(t)=3 t^{5}-5 t^{4}-120 t^{3}$

