1. The absolute minimum value of a function is the least value that the function has on its entire domain. A local minimum value of a function is the least value that the function has in some (possibly small) open interval that is contained in its domain.

3. 
   - This function has an absolute maximum that occurs at $x = b$.
   - This function has an absolute minimum that occurs at $x = d$.
   - This function has local maxima occurring at $x = b$, and $x = e$.
   - This function has local minima occurring at $x = d$, and $x = s$.

5. 
   - $f$ has an absolute maximum value of 4 that occurs at $x = 4$.
   - $f$ has an absolute minimum value of 0 that occurs at $x = 7$.
   - $f$ has a local maximum value of 4 that occurs at $x = 4$.
   - $f$ has a local maximum value of 3 that occurs at $x = 6$.
   - $f$ has a local minimum value of 1 that occurs at $x = 2$.
   - $f$ has a local minimum value of 2 that occurs at $x = 5$.

7.

9.
Here is the graph of the function $f(x) = 8 - 3x$ with domain $[1, \infty)$:
This function has an absolute maximum value of 5 that occurs at \( x = 1 \). It has no absolute minimum. It also has no local maxima or minima.

23. To find the critical numbers of the function \( f(x) = 5x^2 + 4x \), we compute

\[
 f'(x) = 10x + 4
\]

and set \( f'(x) = 0 \) (and solve for \( x \)).

\[
 10x + 4 = 0
\]

\[
 \Rightarrow x = -\frac{2}{5}.
\]

The only critical number of \( f \) is \(-2/5\).

31. For \( f(\theta) = \sin^2(2\theta) \), we have

\[
 f'(\theta) = 4 \sin(2\theta) \cos(2\theta) = 2 \sin(4\theta).
\]

The critical numbers of \( f \) are those numbers, \( \theta \), for which \( \sin(4\theta) = 0 \).

The solutions of \( \sin(4\theta) = 0 \) are

\[
 4\theta = n\pi \quad \text{or} \quad \theta = \frac{n\pi}{4}.
\]

Thus every integer multiple of \( \pi/4 \) is a critical number of \( f \). The graph of \( f \) is shown below.

39. For the function \( f(x) = x^2 + 2x^{-1} \) with domain \( \left[ \frac{1}{2}, 2 \right] \), we have
\[ f'(x) = 2x - 2x^{-2} \]
\[ = 2x^{-2} (x^3 - 1) \]
\[ = \frac{2(x^3 - 1)}{x^2}. \]

The points where \( f'(x) = 0 \) are the points where \( x^3 - 1 = 0 \). The only point at which this is true is \( x = 1 \). Thus \( x = 1 \) is a critical number of \( f \). It is also true that \( f'(0) \) is not defined. However, \( x = 0 \) is not a critical number of \( f \) because 0 is not in the domain of \( f \).

Evaluating \( f \) at its critical number and at each of the endpoints of the interval \([\frac{1}{2}, 2]\), we obtain

- \( f(1) = 1^2 + 2/1 = 3 \)
- \( f\left(\frac{1}{2}\right) = \left(\frac{1}{2}\right)^2 + \frac{2}{\sqrt{2}} = \frac{1}{4} + 4 = 4.25 \)
- \( f(2) = 2^2 + 2/2 = 5 \).

We conclude that \( f \) has an absolute maximum value of 5 that occurs at \( x = 2 \), and an absolute minimum value of 3 that occurs at \( x = 1 \). See the graph of \( f \) below:

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**Graph of \( f(x) = x^2 + 2/x \)**

53. Here is the graph of the function

\[ I(t) = 0.00009045t^5 + 0.001438t^4 - 0.06561t^3 + 0.4598t^2 - 0.6270t + 99.33 \]

on the interval \([0, 10]\).
By looking at this graph, it looks like food was most expensive in about 1989 and cheapest in 1994.

We could try to find the exact value of \( t \) at which the local maximum occurs by computing \( I'(t) \) (which is easy) and then setting \( I'(t) = 0 \) and solving for \( t \). However, \( I' \) is a polynomial function of degree 4 and it is not easy to solve the equation \( I'(t) = 0 \). (There is an answer given in the back of the book. I assume that it was obtained numerically by using computer software that estimates numerical solutions. This can also be done on your calculator, by the way.)