1. [–/1 Points]   **DETAILS**   SCALCET9 4.1.001.

Explain the difference between an absolute minimum and a local minimum.

○ There is no difference.

○ A function *f* has an **absolute minimum** at *x* = *c* if *f*(*c*) is the smallest function value when *x* is near *c*, whereas *f* has a **local minimum** at *c* if *f*(*c*) is the smallest function value on the entire domain of *f*.

○ A function *f* has an **absolute minimum** at *x* = *c* if *f*(*c*) is the largest function value on the entire domain of *f*, whereas *f* has a **local minimum** at *c* if *f*(*c*) is the largest function value when *x* is near *c*.

○ A function *f* has an **absolute minimum** at *x* = *c* if *f*(*c*) is the largest function value when *x* is near *c*, whereas *f* has a **local minimum** at *c* if *f*(*c*) is the largest function value on the entire domain of *f*.

○ A function *f* has an **absolute minimum** at *x* = *c* if *f*(*c*) is the smallest function value on the entire domain of *f*, whereas *f* has a **local minimum** at *c* if *f*(*c*) is the smallest function value when *x* is near *c*.
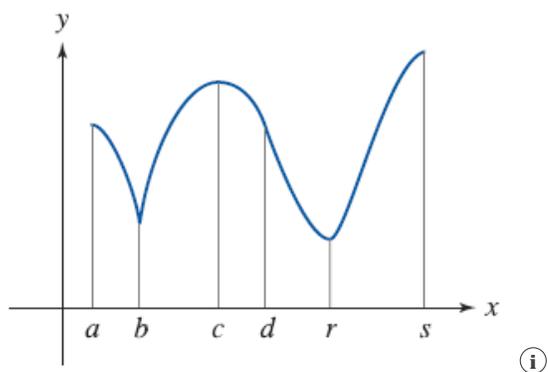
Need Help?   Watch It

2. [–/1 Points]   **DETAILS**   SCALCET9 4.1.003.

For each of the numbers a, b, c, d, r, and s, state whether the function whose graph is shown has an absolute maximum or minimum, a local maximum or minimum, or neither a maximum nor a minimum. (Enter your answers as a comma-separated list.)

absolute maximum

absolute minimum

local maximum

local minimum

neither a maximum nor a minimum

---

3. **[–/2 Points]**   **DETAILS**   SCALCET9 4.1.019.

Sketch the graph of *f* and use your sketch to find the absolute and local maximum and minimum values of *f*. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$$f(x) = \sin(x), \quad 0 \le x < \frac{\pi}{2}$$

absolute maximum value

[   ]

[   ]

absolute minimum value

[   ]

[   ]

local maximum value(s)

[   ]

[   ]

local minimum value(s)

[   ]

[   ]

---

4. **[–/2 Points]**   **DETAILS**   SCALCET9 4.XP.1.022.

Find the critical numbers of the function. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$$f(x) = 8x^3 - 12x^2 - 48x$$

x =

[   ]

[   ]

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5. [–/1 Points]   **DETAILS**   SCALCET9 4.1.039.MI.

Find the critical numbers of the function. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$$h(t) = t^{3/4} - 9t^{1/4}$$

$t =$

[ ]

[ ]

Need Help?   [Watch It]   [Master It]

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6. [–/1 Points]   **DETAILS**   SCALCET9 4.1.045.

Find the critical numbers of the function. (Enter your answers as a comma-separated list. Use n to denote any arbitrary integer values. If an answer does not exist, enter DNE.)

$$f(\theta) = 16 \cos(\theta) + 8 \sin^2(\theta)$$

$\theta =$

[ ]

[ ]

Need Help?   [Watch It]

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7. [–/1 Points]   **DETAILS**   SCALCET9 4.1.051.

Find the absolute maximum and absolute minimum values of f on the given interval.

$$f(x) = 16 + 4x - x^2, \quad [0, 5]$$

absolute minimum value   [ ]

[ ]

absolute maximum value   [ ]

[ ]

Need Help?   [Watch It]

8. **[–/1 Points]**   **DETAILS**   SCALCET9 4.1.053.MI.

Find the absolute maximum and absolute minimum values of f on the given interval.

$$f(x) = 4x^3 - 18x^2 - 48x + 3, \quad [-2, 5]$$

absolute minimum value

absolute maximum value

Need Help?   [Watch It]   [Master It]

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9. **[–/1 Points]**   **DETAILS**   SCALCET9 4.1.053.MI.SA.

This question has several parts that must be completed sequentially. If you skip a part of the question, you will not receive any points for the skipped part, and you will not be able to come back to the skipped part.

Tutorial Exercise

Find the absolute maximum and absolute minimum values of f on the given interval.

$$f(x) = 4x^3 - 6x^2 - 144x + 2, \quad [-4, 5]$$

[Click here to begin!]

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10. **[–/1 Points]**   **DETAILS**   SCALCET9 4.1.061.

Find the absolute maximum and absolute minimum values of f on the given interval.

$$f(t) = 2\cos(t) + \sin(2t), \quad \left[0, \frac{\pi}{2}\right]$$

absolute minimum value

absolute maximum value

---

11. [–/1 Points]   **DETAILS**   SCALCET9 4.1.072.

Consider the following.

$$f(x) = 5x - 10\cos(x), \qquad -2 \le x \le 0$$

Use technology to estimate the absolute maximum and minimum values. (Round your answers to two decimal places.)

absolute maximum [   ]
absolute minimum [   ]

Use calculus to find the exact maximum and minimum values.

absolute maximum [   ]

[   ]

absolute minimum [   ]

[   ]

---

12. [–/1 Points]   **DETAILS**   SCALCET9 4.1.075.

Between 0°C and 30°C, the volume V (in cubic centimeters) of 1 kg of water at a temperature T is given approximately by the formula

$$V = 999.87 - 0.06426T + 0.0085043T^2 - 0.0000679T^3$$

Find the temperature at which water has its maximum density. (Round your answer to four decimal places.)

$T = $ [   ] °C

Need Help?   [Watch It]

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13. [–/1 Points]   **DETAILS**   SCALCET9 4.1.061.MI.SA.

This question has several parts that must be completed sequentially. If you skip a part of the question, you will not receive any points for the skipped part, and you will not be able to come back to the skipped part.

Tutorial Exercise
Find the absolute maximum and absolute minimum values of f on the given interval.

$$f(t) = 18\cos(t) + 9\sin(2t), \qquad \left[0, \frac{\pi}{2}\right]$$

[Click here to begin!]

14. **[–/1 Points]**   **DETAILS**   SCALCET9 4.1.061.MI.

Find the absolute minimum and absolute maximum values of *f* on the given interval.

$$f(t) = 12 \cos(t) + 6 \sin(2t), \quad \left[0, \frac{\pi}{2}\right]$$

absolute minimum value

absolute maximum value

Need Help? [Watch It] [Master It]

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15. **[–/1 Points]**   **DETAILS**   SCALCET9 4.XP.1.010.MI.

Find the critical numbers of the function. (Enter your answers as a comma-separated list.)

$$f(x) = x^3 + 3x^2 - 24x$$

x =

Need Help? [Master It]

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16. **[–/1 Points]**   **DETAILS**   SCALCET9 4.XP.1.010.MI.SA.

This question has several parts that must be completed sequentially. If you skip a part of the question, you will not receive any points for the skipped part, and you will not be able to come back to the skipped part.

Tutorial Exercise
Find the critical numbers of the function.

$$f(x) = x^3 + 3x^2 - 45x$$

[Click here to begin!]
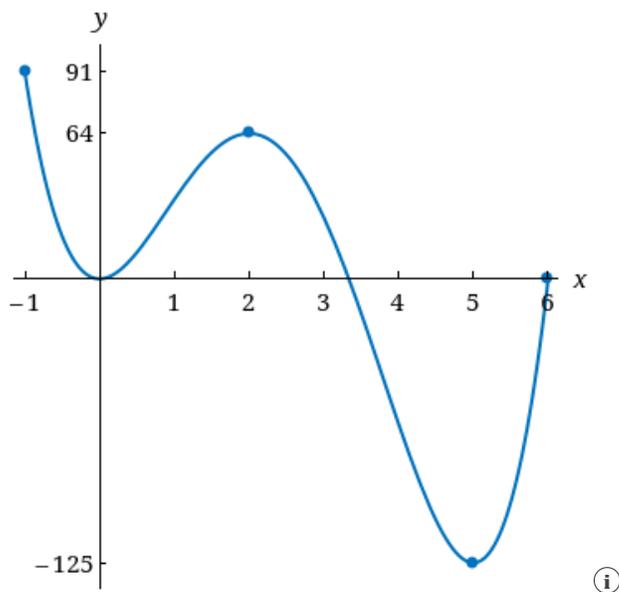
17. **[–/1 Points]**   **DETAILS**   SCALCET9 4.1.AE.001.

Example 1

Video Example 🔊

The graph of the function

$$f(x) = 3x^4 - 28x^3 + 60x^2 \quad -1 \le x \le 6$$

is shown in the figure.

You can see that $f(2) = \boxed{}$ is a local maximum whereas the absolute maximum is $f\left(\boxed{}\right) = \boxed{}$. (This absolute maximum is not a local maximum because it occurs at an endpoint.) Also, $f(0) = \boxed{}$ is a local minimum and $f(5) = \boxed{}$ is both a local and an absolute minimum. Note that f has neither a local nor an absolute maximum at $x = 6$.

18. [–/1 Points]   **DETAILS**   SCALCET9 4.1.AE.008.

Example 8

Find the absolute maximum and minimum values of the function below.

$$f(x) = x^3 - 9x^2 + 3, \qquad -\frac{3}{2} \le x \le 12$$

Solution

Since f is continuous on $\left[-\frac{3}{2}, 12\right]$, we can use the Closed Interval Method.

$$f(x) = x^3 - 9x^2 + 3$$

$$f'(x) = \boxed{}$$

.

Since $f'(x)$ exists for all x, the only critical numbers of f occur when $f'(x) = \boxed{}$, that is, $x = 0$ or $x = \boxed{}$.

Notice that each of these critical numbers lies in $\left(-\frac{3}{2}, 12\right)$. The values of f at these critical numbers are

$f(0) = \boxed{}$ and $f(6) = \boxed{}$.

The values of f at the endpoints of the interval are

$f\left(-\frac{3}{2}\right) = \boxed{}$ and $f(12) = \boxed{}$.

Comparing these four numbers, we see that the absolute maximum value is $f(12) = \boxed{}$ and the absolute minimum value is $f(6) = \boxed{}$.

Note that in this example the absolute maximum occurs at an endpoint, whereas the absolute minimum occurs at a critical number. The graph of f is sketched in the figure below.