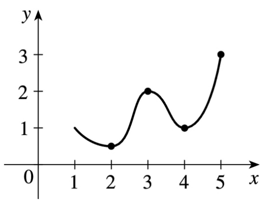
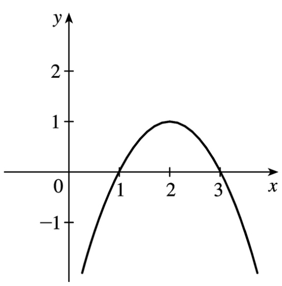
1. A function f has an **absolute minimum** at $x=c$ if $f(c)$ is the smallest function value on the entire domain of f, whereas f has a **local minimum** at c if $f(c)$ is the smallest function value when x is near c.

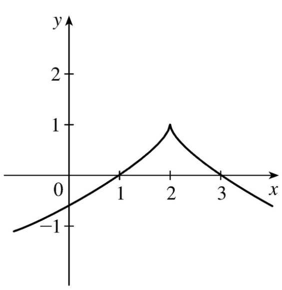
3. Absolute maximum at b; absolute minimum at d; local maxima at b and e; local minima at d and s;
neither a maximum nor a minimum at a, c, r, and t.

9. Absolute maximum at 5, absolute minimum at 2, local maximum at 3, local minima at 2 and 4

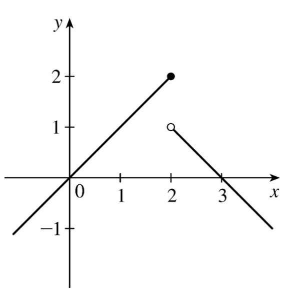




11. **(a)**



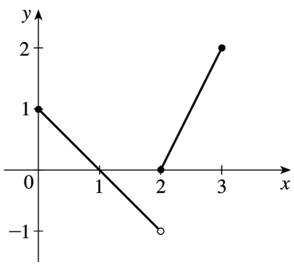
(b)



(c)

29. $f(x)=\begin{cases} 1-x & \text{if } 0\le x<2 \\ 2x-4 & \text{if } 2\le x\le 3 \end{cases}$

Absolute maximum $f(3)=2$; no local maximum. No absolute or local minimum.



33. $f(x)=x^3+3x^2-24x \Rightarrow f'(x)=3x^2+6x-24=3\left(x^2+2x-8\right)$.
$f'(x)=0 \Rightarrow 3(x+4)(x-2)=0 \Rightarrow x=-4$, 2. These are the only critical numbers.

41. $F(x)=x^{4/5}(x-4)^2 \Rightarrow$

$$F'(x)=x^{4/5}\cdot 2(x-4)+(x-4)^2\cdot \frac{4}{5}x^{-1/5}=\frac{1}{5}x^{-1/5}(x-4)[5\cdot x\cdot 2+(x-4)\cdot 4]$$

$$=\frac{(x-4)(14x-16)}{5x^{1/5}}=\frac{2(x-4)(7x-8)}{5x^{1/5}}=0 \text{ when } x=4,\ \frac{8}{7}\ \text{; and } F'(0) \text{ does not exist.}$$

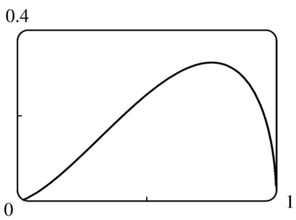
Critical numbers are 0 , $\frac{8}{7}$, 4.

43. $f(\theta)=2\cos\theta+\sin^2\theta \Rightarrow f'(\theta)=-2\sin\theta+2\sin\theta\cos\theta$. $f'(\theta)=0 \Rightarrow 2\sin\theta(\cos\theta-1)=0 \Rightarrow \sin\theta=0$ or $\cos\theta=1 \Rightarrow \theta=n\pi$ (n an integer) or $\theta=2n\pi$. The solutions $\theta=n\pi$ include the solutions $\theta=2n\pi$, so the critical numbers are $\theta=n\pi$.

49. $f(x)=x^4-2x^2+3$, $[-2,3]$. $f'(x)=4x^3-4x=4x\left(x^2-1\right)=4x(x+1)(x-1)=0 \Leftrightarrow x=-1$, 0 , 1. $f(-2)=11$, $f(-1)=2$, $f(0)=3$, $f(1)=2$, $f(3)=66$. So $f(3)=66$ is the absolute maximum value and $f(\pm 1)=2$ is the absolute minimum value.

51. $f(x)=\dfrac{x}{x^2+1}$, $[0,2]$. $f'(x)=\dfrac{\left(x^2+1\right)-x(2x)}{\left(x^2+1\right)^2}=\dfrac{1-x^2}{\left(x^2+1\right)^2}=0 \Leftrightarrow x=\pm 1$, but -1 is not in $[0,2]$. $f(0)=0$, $f(1)=\frac{1}{2}$, $f(2)=\frac{2}{5}$. So $f(1)=\frac{1}{2}$ is the absolute maximum value and $f(0)=0$ is the absolute minimum value.

55. $f(x)=\sin x+\cos x$, $\left[0, \frac{\pi}{3}\right]$. $f'(x)=\cos x-\sin x=0 \Leftrightarrow \sin x=\cos x \Rightarrow \frac{\sin x}{\cos x}=1 \Rightarrow \tan x=1 \Rightarrow$ $x=\frac{\pi}{4}$. $f(0)=1$, $f\left(\frac{\pi}{4}\right)=\sqrt{2}\approx 1.41$, $f\left(\frac{\pi}{3}\right)=\frac{\sqrt{3}+1}{2}\approx 1.37$. So $f\left(\frac{\pi}{4}\right)=\sqrt{2}$ is the absolute maximum value and $f(0)=1$ is the absolute minimum value.

61. **(a)** 

From the graph, it appears that the absolute maximum value is about $f(0.75)=0.32$, and the absolute minimum value is $f(0)=f(1)=0$; that is, at both endpoints.

(b) $f(x)=x\sqrt{x-x^2} \Rightarrow f'(x)=x\cdot\frac{1-2x}{2\sqrt{x-x^2}}+\sqrt{x-x^2}=\frac{(x-2x^2)+(2x-2x^2)}{2\sqrt{x-x^2}}=\frac{3x-4x^2}{2\sqrt{x-x^2}}$. So $f'(x)=0 \Rightarrow$ $3x-4x^2=0 \Rightarrow x(3-4x)=0 \Rightarrow x=0$ or $\frac{3}{4}$. $f(0)=f(1)=0$ [minimum],

and $f\left(\frac{3}{4}\right)=\frac{3}{4}\sqrt{\frac{3}{4}-\left(\frac{3}{4}\right)^2}=\frac{3\sqrt{3}}{16}$ [maximum].