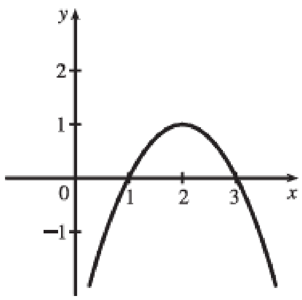
3. Absolute maximum at s, absolute minimum at r, local maximum at c, local minima at b and r, neither a maximum nor a minimum at a and d.

4. Absolute maximum at r; absolute minimum at a; local maxima at b and r; local minimum at d; neither a maximum nor a minimum at c and s.

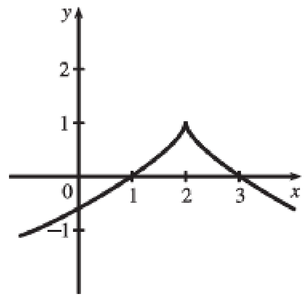
5. Absolute maximum value is $f(4) = 5$; there is no absolute minimum value; local maximum values are $f(4) = 5$ and $f(6) = 4$; local minimum values are $f(2) = 2$ and $f(1) = f(5) = 3$.

6. There is no absolute maximum value; absolute minimum value is $g(4) = 1$; local maximum values are $g(3) = 4$ and $g(6) = 3$; local minimum values are $g(2) = 2$ and $g(4) = 1$.

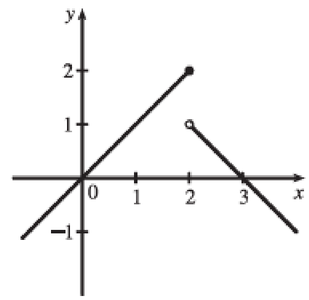
11. (a)



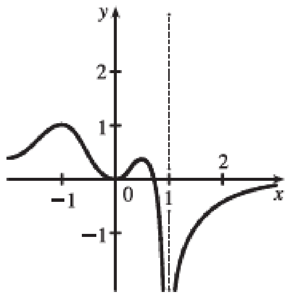
(b)



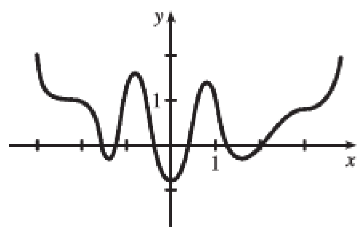
(c)



14. (a)



(b)



29. $f(x) = 5x^2 + 4x \quad\Rightarrow\quad f'(x) = 10x + 4.\quad f'(x) = 0 \quad\Rightarrow\quad x = -\frac{2}{5}$, so $-\frac{2}{5}$ is the only critical number.

36. $h(p) = \dfrac{p-1}{p^2+4} \quad\Rightarrow\quad h'(p) = \dfrac{(p^2+4)(1) - (p-1)(2p)}{(p^2+4)^2} = \dfrac{p^2 + 4 - 2p^2 + 2p}{(p^2+4)^2} = \dfrac{-p^2 + 2p + 4}{(p^2+4)^2}.$

$h'(p) = 0 \quad\Rightarrow\quad p = \dfrac{-2 \pm \sqrt{4+16}}{-2} = 1 \pm \sqrt{5}$. The critical numbers are $1 \pm \sqrt{5}$. [$h'(p)$ exists for all real numbers.]

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

44. $f(x) = x^{-2} \ln x \quad \Rightarrow \quad f'(x) = x^{-2}(1/x) + (\ln x)(-2x^{-3}) = x^{-3} - 2x^{-3} \ln x = x^{-3}(1 - 2\ln x) = \dfrac{1 - 2\ln x}{x^3}$.

$f'(x) = 0 \quad \Rightarrow \quad 1 - 2\ln x = 0 \quad \Rightarrow \quad \ln x = \frac{1}{2} \quad \Rightarrow \quad x = e^{1/2} \approx 1.65$. $f'(0)$ does not exist, but 0 is not in the domain of f, so the only critical number is $\sqrt{e}$.

47. $f(x) = 3x^2 - 12x + 5,\ [0, 3]$. $f'(x) = 6x - 12 = 0 \quad \Leftrightarrow \quad x = 2$. Applying the Closed Interval Method, we find that $f(0) = 5$, $f(2) = -7$, and $f(3) = -4$. So $f(0) = 5$ is the absolute maximum value and $f(2) = -7$ is the absolute minimum value.

52. $f(x) = (x^2 - 1)^3,\ [-1, 2]$. $f'(x) = 3(x^2 - 1)^2(2x) = 6x(x + 1)^2(x - 1)^2 = 0 \quad \Leftrightarrow \quad x = -1, 0, 1$. $f(\pm 1) = 0$, $f(0) = -1$, and $f(2) = 27$. So $f(2) = 27$ is the absolute maximum value and $f(0) = -1$ is the absolute minimum value.

57. $f(t) = 2\cos t + \sin 2t,\ [0, \pi/2]$.

$f'(t) = -2\sin t + \cos 2t \cdot 2 = -2\sin t + 2(1 - 2\sin^2 t) = -2(2\sin^2 t + \sin t - 1) = -2(2\sin t - 1)(\sin t + 1)$.

$f'(t) = 0 \quad \Rightarrow \quad \sin t = \frac{1}{2}$ or $\sin t = -1 \quad \Rightarrow \quad t = \frac{\pi}{6}$. $f(0) = 2$, $f(\frac{\pi}{6}) = \sqrt{3} + \frac{1}{2}\sqrt{3} = \frac{3}{2}\sqrt{3} \approx 2.60$, and $f(\frac{\pi}{2}) = 0$.

So $f(\frac{\pi}{6}) = \frac{3}{2}\sqrt{3}$ is the absolute maximum value and $f(\frac{\pi}{2}) = 0$ is the absolute minimum value.

62. $f(x) = e^{-x} - e^{-2x},\ [0, 1]$. $f'(x) = e^{-x}(-1) - e^{-2x}(-2) = \dfrac{2}{e^{2x}} - \dfrac{1}{e^x} = \dfrac{2 - e^x}{e^{2x}} = 0 \quad \Leftrightarrow \quad e^x = 2 \quad \Leftrightarrow$

$x = \ln 2 \approx 0.69$. $f(0) = 0$, $f(\ln 2) = e^{-\ln 2} - e^{-2\ln 2} = (e^{\ln 2})^{-1} - (e^{\ln 2})^{-2} = 2^{-1} - 2^{-2} = \frac{1}{2} - \frac{1}{4} = \frac{1}{4}$,

$f(1) = e^{-1} - e^{-2} \approx 0.233$. So $f(\ln 2) = \frac{1}{4}$ is the absolute maximum value and $f(0) = 0$ is the absolute minimum value.