1. $f(x) = x - 3 = x^1 - 3 \quad \Rightarrow \quad F(x) = \dfrac{x^{1+1}}{1+1} - 3x + C = \frac{1}{2}x^2 - 3x + C$

Check: $F'(x) = \frac{1}{2}(2x) - 3 + 0 = x - 3 = f(x)$

6. $f(x) = x\,(2-x)^2 = x\,(4 - 4x + x^2) = 4x - 4x^2 + x^3 \quad \Rightarrow$

$F(x) = 4\left(\frac{1}{2}x^2\right) - 4\left(\frac{1}{3}x^3\right) + \frac{1}{4}x^4 + C = 2x^2 - \frac{4}{3}x^3 + \frac{1}{4}x^4 + C$

13. $f(u) = \dfrac{u^4 + 3\sqrt{u}}{u^2} = \dfrac{u^4}{u^2} + \dfrac{3u^{1/2}}{u^2} = u^2 + 3u^{-3/2} \quad \Rightarrow$

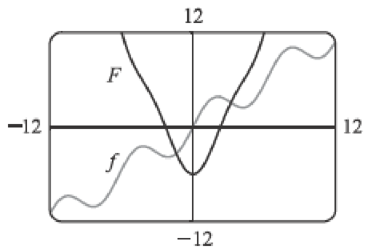
$F(u) = \dfrac{u^3}{3} + 3\,\dfrac{u^{-3/2+1}}{-3/2+1} + C = \dfrac{1}{3}u^3 + 3\dfrac{u^{-1/2}}{-1/2} + C = \dfrac{1}{3}u^3 - \dfrac{6}{\sqrt{u}} + C$

20. $f(x) = x + 2\sin x \quad \Rightarrow \quad F(x) = \frac{1}{2}x^2 - 2\cos x + C.$

$F(0) = -6 \quad \Rightarrow \quad 0 - 2 + C = -6 \quad \Rightarrow \quad C = -4$, so

$F(x) = \frac{1}{2}x^2 - 2\cos x - 4.$

The graph confirms our answer since $f(x) = 0$ when F has a local minimum, f is positive when F is increasing, and f is negative when F is decreasing.



21. $f''(x) = 6x + 12x^2 \quad \Rightarrow \quad f'(x) = 6 \cdot \dfrac{x^2}{2} + 12 \cdot \dfrac{x^3}{3} + C = 3x^2 + 4x^3 + C \quad \Rightarrow$

$f(x) = 3 \cdot \dfrac{x^3}{3} + 4 \cdot \dfrac{x^4}{4} + Cx + D = x^3 + x^4 + Cx + D$ [C and D are just arbitrary constants]

26. $f'''(t) = t - \sqrt{t} \quad \Rightarrow \quad f''(t) = \frac{1}{2}t^2 - \frac{2}{3}t^{3/2} + C \quad \Rightarrow \quad f'(t) = \frac{1}{6}t^3 - \frac{4}{15}t^{5/2} + Ct + D \quad \Rightarrow$

$f(t) = \frac{1}{24}t^4 - \frac{8}{105}t^{7/2} + \frac{1}{2}Ct^2 + Dt + E$

31. $f'(t) = 2\cos t + \sec^2 t \quad \Rightarrow \quad f(t) = 2\sin t + \tan t + C$ because $-\pi/2 < t < \pi/2$.

$f\left(\frac{\pi}{3}\right) = 2\left(\sqrt{3}/2\right) + \sqrt{3} + C = 2\sqrt{3} + C$ and $f\left(\frac{\pi}{3}\right) = 4 \quad \Rightarrow \quad C = 4 - 2\sqrt{3}$, so $f(t) = 2\sin t + \tan t + 4 - 2\sqrt{3}$.

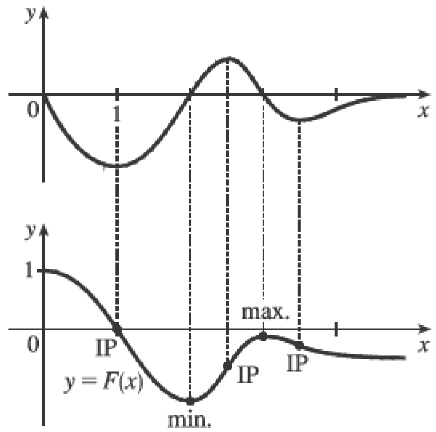
40. $f'''(x) = \cos x \quad \Rightarrow \quad f''(x) = \sin x + C.$ $f''(0) = C$ and $f''(0) = 3 \quad \Rightarrow \quad C = 3.$ $f''(x) = \sin x + 3 \quad \Rightarrow$

$f'(x) = -\cos x + 3x + D.$ $f'(0) = -1 + D$ and $f'(0) = 2 \quad \Rightarrow \quad D = 3.$ $f'(x) = -\cos x + 3x + 3 \quad \Rightarrow$

$f(x) = -\sin x + \frac{3}{2}x^2 + 3x + E.$ $f(0) = E$ and $f(0) = 1 \quad \Rightarrow \quad E = 1.$ Thus, $f(x) = -\sin x + \frac{3}{2}x^2 + 3x + 1.$

44. We know right away that c cannot be f's antiderivative, since the slope of c is not zero at the x-value where $f = 0$. Now f is positive when a is increasing and negative when a is decreasing, so a is the antiderivative of f.

45.



The graph of F must start at $(0, 1)$. Where the given graph, $y = f(x)$, has a local minimum or maximum, the graph of F will have an inflection point.

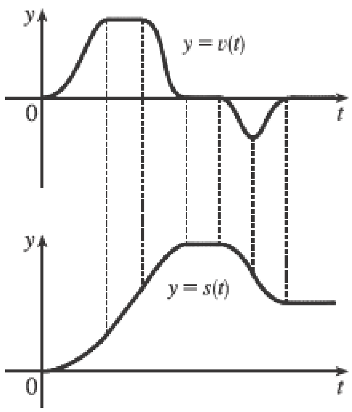
Where f is negative (positive), F is decreasing (increasing).

Where f changes from negative to positive, F will have a minimum.

Where f changes from positive to negative, F will have a maximum.

Where f is decreasing (increasing), F is concave downward (upward).

46.



Where v is positive (negative), s is increasing (decreasing).

Where v is increasing (decreasing), s is concave upward (downward).

Where v is horizontal (a steady velocity), s is linear.