

1. For each problem, I have listed two different functions that have the given derivative.

(a) •  $y = 3x + 2$   
•  $y = 3x - 3$

(b) •  $y = x^3 + 5$   
•  $y = x^3 - 7$

(c) •  $w = 2x^4 - \frac{1}{3}x^3 + \frac{5}{2}x^2 - 10x + 11$   
•  $w = 2x^4 - \frac{1}{3}x^3 + \frac{5}{2}x^2 - 10x - 13$

(d) •  $h = 4 \ln(t) + 17$   
•  $h = 4 \ln(t) - 19$

(e) •  $y = 30e^x + 5x + 23$   
•  $y = 30e^x + 5x - 29$

(f) •  $q = -50e^{-t} + 31$   
•  $q = -50e^{-t} - 37$

(g) •  $P = \frac{1}{4}t^4 - \frac{1}{2}t^{-2} + 41$   
•  $P = \frac{1}{4}t^4 - \frac{1}{2}t^{-2} - 43$

(h) •  $y = \ln(x + 4) + 47$   
•  $y = \ln(x + 4) - 53$

(i) •  $z = \frac{1}{3}e^{3y} + 59$   
•  $z = \frac{1}{3}e^{3y} - 61$

(j) •  $v = -100e^{-r} + 67$   
•  $v = -100e^{-r} - 71$

(k) •  $s = 4e^t - 3^{-t} + 73$   
•  $s = 4e^t - 3^{-t} - 79$

(l) •  $P = 2\sqrt{t} + 83$   
•  $P = 2\sqrt{t} - 89$

(m) •  $P = 2 \ln(t) + 3t^{-1} + 97$   
•  $P = 2 \ln(t) + 3t^{-1} - 101$

(n) •  $h = 15e^{2s} + \frac{1}{3}e^{3s} + 103$   
•  $h = 15e^{2s} + \frac{1}{3}e^{3s} - 107$

(o) •  $P = 100e^{0.05t} + 109$   
•  $P = 100e^{0.05t} - 113$

(p) •  $y = \frac{1}{2}e^{x^2} + 127$   
•  $y = \frac{1}{2}e^{x^2} - 131$

(q) •  $y = (x^2 + 1)^4 + 137$   
•  $y = (x^2 + 1)^4 - 139$

(r) •  $y = \frac{8}{3}(x^3 + 7)^{3/2} + 149$   
•  $y = \frac{8}{3}(x^3 + 7)^{3/2} - 151$

(s) •  $y = 6e^{-0.25x^2} + 157$   
•  $y = 6e^{-0.25x^2} - 163$

2. The indefinite integral represents the most general antiderivative of the integrand and so is an entire family of functions (hence the  $+C$ ).

$$(a) \int 3 dx = 3x + C$$

$$(b) \int 3x^2 dx = x^3 + C$$

$$(c) \int (8x^3 - x^2 + 5x - 10) dx = 2x^4 - \frac{1}{3}x^3 + \frac{5}{2}x^2 - 10x + C$$

$$(d) \int \frac{4}{t} dx = 4 \ln(t) + C$$

$$(e) \int (30e^x + 5) dx = 30e^x + 5x + C$$

$$(f) \int 50e^{-t} dt = -50e^{-t} + C$$

$$(g) \int \left(t^3 + \frac{1}{t^3}\right) dt = \frac{1}{4}t^4 - \frac{1}{2}t^{-2} + C$$

$$(h) \int \frac{1}{x+4} dx = \ln(x+4) + C$$

$$(i) \int e^{3y} dy = \frac{1}{3}e^{3y} + C$$

$$(j) \int \frac{100}{e^r} dr = -100e^{-r} + C$$

$$(k) \int (4e^t + 3e^{-t}) dt = 4e^t - 3e^{-t} + C$$

$$(l) \int \frac{1}{\sqrt{t}} dt = 2\sqrt{t} + C$$

$$(m) \int \left( \frac{2}{t} - \frac{3}{t^2} \right) dt = 2 \ln(t) + 3t^{-1} + C$$

$$(n) \int (30e^{2s} + e^{3s}) ds = 15e^{2s} + \frac{1}{3}e^{3s} + C$$

$$(o) \int 5e^{0.05t} dt = 100e^{0.05t} + C$$

$$(p) \int xe^{x^2} dx = \frac{1}{2}e^{x^2} + C$$

$$(q) \int 8x(x^2 + 1)^3 dx = (x^2 + 1)^4 + C$$

$$(r) \int 12x^2\sqrt{x^3 + 7} dx = \frac{8}{3}(x^3 + 7)^{3/2} + C$$

$$(s) \int -3xe^{-0.25x^2} dx = 6e^{-0.25x^2} + C$$

3. (a)  $q = 3.2r + 2.5$

(b)  $h = \ln(10) \cdot s + 8$

(c)  $q = 30e^{-0.4t}$

(d)  $w = 0.3z^2 + 40$

(e)  $v = \frac{-1}{q - 11}$

(f)  $P = \left( \frac{t + 2\sqrt{10}}{2} \right)^2$

(g)  $y = 2t^3 + 5t + 8$

(h)  $w = \sqrt[3]{x^2 - 5x + 8}$

(i)  $y = \sqrt[3]{t^2 + 125}$

(j)  $y = 4(x^2 + 1)^5$

(k)  $s = \left( \frac{5}{3}r + 2\sqrt[3]{4} - \frac{50}{3} \right)^{3/5}$

(l)  $g = \ln(s - 2) + 4 - \ln(3)$

(m)  $r = \sqrt{\ln(v + 3)}$  or  $r = -\sqrt{\ln(v + 3)}$

$$(n) \quad q = 0.2r^2 + 300$$

$$(o) \quad h = 400e^{0.1r}$$

$$(p) \quad P = 500e^{-0.2t}$$

$$(q) \quad w = 3e^{2t} + 5$$

$$(r) \quad y = \ln(x + 1)$$

$$(s) \quad y = -e^{-x} + 1$$

$$(t) \quad W = 2x^4 + x^3 + 5$$

$$(u) \quad q = -t^{-1} + 4$$

$$(v) \quad q = \sqrt[3]{3t + 24}$$

$$(w) \quad y = \frac{-1}{3x^3 - 4}$$

$$(x) \quad y = 60e^x - 10$$

$$(y) \quad y = \frac{1}{2}x^2 + 10x + 50$$

$$(z) \quad P = \frac{kP_0e^{rt}}{k + P_0(e^{rt} - 1)}$$