

Section §5.1

$$\left(-\frac{2}{y^2}\right)' = (-2y^{-2})' = 4y^{-3} = \frac{4}{y^3} \quad (1)$$

# 2 page 326

$$(8\sqrt{x})' = (8x^{\frac{1}{2}})' = 8 \cdot \frac{1}{2} x^{-\frac{1}{2}} = \frac{4}{\sqrt{x}} \quad \checkmark \quad \# 16 \text{ page } 326$$

$$\int dr = r + C \quad (r)' = 1$$

# 4 page 326

$$\begin{aligned} (x - 3\sqrt[3]{x})' &= (x - 3x^{\frac{1}{3}})' \\ &= 1 - 3 \cdot \frac{1}{3} x^{-\frac{2}{3}} = 1 - \frac{1}{\sqrt[3]{x^2}} \quad \checkmark \end{aligned}$$

# 18 page 326

$$\int e^3 dy = e^3 y + C$$

$$(e^3)' = e^3$$

# 7 page 326

$$\begin{aligned} \left(\frac{2(x^2+3)}{3\sqrt{x}}\right)' &= \left[\frac{2}{3}(x^{\frac{3}{2}} + 3x^{-\frac{1}{2}})\right]' \\ &= \frac{2}{3} \cdot \frac{3}{2} x^{\frac{1}{2}} + \frac{2}{3} \cdot 3 \cdot \left(-\frac{1}{2}\right) x^{-\frac{3}{2}} \\ &= x^{\frac{1}{2}} - x^{-\frac{3}{2}} = x^{-\frac{3}{2}}(x^2 - 1) \\ &= \frac{x^2 - 1}{x^{\frac{3}{2}}} \quad \checkmark \end{aligned}$$

# 20 page 326  $\int x^{-\frac{1}{2}} dx$

$$= \frac{x^{\frac{1}{2}}}{\frac{1}{2}} + C = 2x^{\frac{1}{2}} + C$$

$$\left(2x^{\frac{1}{2}}\right)' = 2 \cdot \frac{1}{2} x^{-\frac{1}{2}} = x^{-\frac{1}{2}} \quad \checkmark$$

# 22 page 326

$$\int \frac{1}{x^2} dx = \int x^{-2} dx = \frac{x^{-1}}{-1} + C = -\frac{1}{x} + C$$

# 10 page 326

$$\int -4 dx = -4x + C$$

$$(-4x)' = -4 \quad \checkmark$$

# 24 page 326

$$\int \frac{1}{x^2 \sqrt{x}} dx = \int x^{-\frac{5}{2}} dx = \frac{x^{-\frac{3}{2}}}{-\frac{3}{2}} + C$$

$$= -\frac{2}{3} \frac{1}{x\sqrt{x}} + C$$

# 12 page 326

$$\int 3t^4 dt = 3 \frac{t^5}{5} + C$$

$$\left(\frac{3}{5}t^5 + C\right)' = \frac{3}{5} \cdot 5 \cdot t^4 = 3t^4 \quad \checkmark$$

# 26 page 326

$$\int t(t^2+2) dt = \int t^3 + 2t dt$$

$$= \frac{t^4}{4} + t^2 + C$$

# 14 page 326

$$\int 4y^{-3} dy = \frac{4y^{-2}}{-2} + C = -\frac{2}{y^2} + C$$

# 28 page 326

$$\int \frac{1}{8x^3} dx = \frac{1}{8} \int x^{-3} dx$$

$$= \frac{1}{8} \frac{x^{-2}}{-2} + C = \frac{1}{-16x^2} + C$$

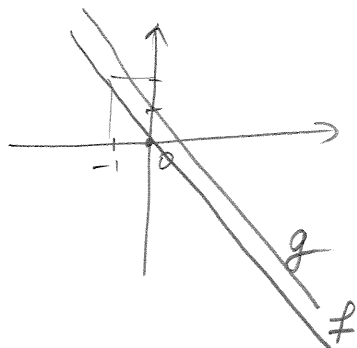
# 30 page 326

$$f' = -2 \Rightarrow f(x) = -2x + C$$

Choose

$$f(x) = -2x$$

$$g(x) = -2x + 1$$



# 32 page 326

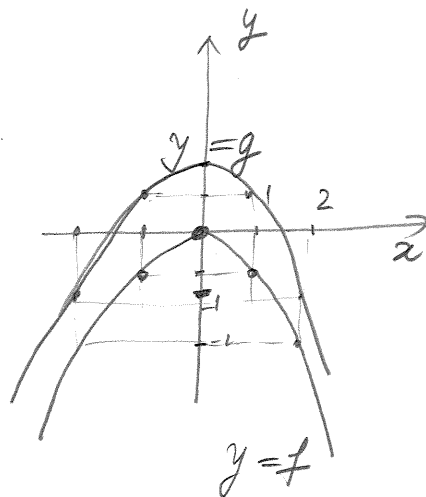
$$f'(x) = -x$$

$$f(x) = -\frac{x^2}{2} + C$$

Choose

$$f(x) = -\frac{x^2}{2}$$

$$g(x) = -\frac{x^2}{2} + 1$$



# 34 page 324

$$\int (x^2 - 2x + 3) dx = \frac{x^3}{3} - x^2 + 3x + C$$

$$\left(\frac{x^3}{3} - x^2 + 3x\right)' = x^2 - 2x + 3$$

# 36 page 324

(2)

$$\int \sqrt{x} + \frac{1}{2\sqrt{x}} dx = \int x^{1/2} + \frac{1}{2} x^{-1/2} dx$$

$$= \frac{x^{3/2}}{3/2} + \frac{1}{2} \cdot \frac{2}{1/2} x^{1/2} + C$$

$$= \left(\frac{2}{3} x \sqrt{x} + \sqrt{x}\right) + C$$

$$\left(\frac{2}{3} x \sqrt{x} + \sqrt{x}\right)' = \left(\frac{2}{3} x^{3/2} + x^{1/2}\right)'$$

$$= \frac{2}{3} \cdot \frac{3}{2} x^{1/2} + \frac{1}{2} x^{-1/2}$$

$$= \sqrt{x} + \frac{1}{2\sqrt{x}} \checkmark$$

# 38 page 324

$$\int (\sqrt[4]{x^3+1}) dx = \int x^{3/4} + 1 dx$$

$$= \frac{x^{7/4}}{7/4} + x + C = \frac{4}{7} x^{7/4} + x + C$$

$$= \left(\frac{4}{7} x \sqrt[4]{x^3} + x\right) + C$$

$$\left(\frac{4}{7} x \sqrt[4]{x^3}\right)' = \left(\frac{4}{7} x^{7/4} + x\right)'$$

$$= \frac{4}{7} \cdot \frac{7}{4} x^{3/4} + 1 = x^{3/4} + 1$$

$$= \sqrt[4]{x^3} + 1 \checkmark$$

# 40 page 324

$$\int \frac{1}{4x^2} dx = \frac{1}{4} \int x^{-2} dx = \frac{1}{4} \frac{x^{-1}}{-1} + C$$

$$= -\frac{1}{4x} + C$$

$$\left(-\frac{1}{4x}\right)' = \left(-\frac{1}{4}x^{-1}\right)' = \frac{1}{4}x^{-2} = \frac{1}{4x^2}$$

#42 page 324  $\int \frac{t^2+2}{t^2} dt$

$$= \int 1 + \frac{2}{t} dt = \int 1 + 2t^{-1} dt$$

$$= t + 2\frac{t^{-1}}{-1} + C = t - \frac{2}{t} + C$$

$$\left(t - \frac{2}{t}\right)' = \left(t - 2t^{-1}\right)' = 1 + 2t^{-2}$$

$$= 1 + \frac{2}{t^2} = \frac{t^2+2}{t^2} \checkmark$$

#50 page 324

$$f'(x) = \frac{1}{5}x - 2$$

$$f(x) = \frac{1}{5} \frac{x^2}{2} - 2x + C$$

$$f(10) = -10 \Rightarrow$$

$$\frac{(10)^2}{10} - 2 \cdot 10 + C = -10$$

$$10 - 20 + C = -10 \Rightarrow C = 0$$

$$\Rightarrow f(x) = \frac{x^2}{10} - 2x + C$$

#52 page 324

$$f'(x) = (2x-3)(2x+3), f(3) = 0$$

$$f'(x) = 4x^2 - 9$$

$$f(x) = \int 4x^2 - 9 dx = \frac{4x^3}{3} - 9x + C$$

$$f(3) = 4 \cdot \frac{27}{3} - 9 \cdot 3 + C = 0$$

$$\Leftrightarrow 9 + C = 0 \Rightarrow C = -9$$

$$f(x) = \frac{4}{3}x^3 - 9x - 9$$

#54 page 324

$$f'(x) = \frac{x^2-5}{x^2}, x > 0; f(1) = 2$$

$$f(x) = \int \frac{x^2-5}{x^2} dx = \int 1 - \frac{5}{x^2} dx$$

$$= \int 1 - 5x^{-2} dx = x - \frac{5x^{-1}}{-1} + C$$

$$= x + \frac{5}{x} + C$$

$$f(1) = 1 + 5 + C = 2 \Rightarrow C = -4$$

$$\Rightarrow f(x) = x + \frac{5}{x} - 4$$

#56 page 324

$$\frac{dy}{dx} = 2(x-1)$$

$$y = \int 2(x-1) dx = (x-1)^2 + C$$

$$2 = (3-1)^2 + C$$

$$2 = 4 + C \Rightarrow C = -2$$

$$\Rightarrow y = (x-1)^2 - 2$$

$$y = x^2 - 2x - 1$$

#59 page 32x

$$f''(x) = 2, f'(2) = 5, f(2) = 10$$

$$f'(x) = \int 2 dx = 2x + C$$

$$f'(2) = 2 \cdot 2 + C = 5 \Rightarrow C = 1$$

$$f(x) = \int 2x + 1 dx = x^2 + x + C$$

$$f(2) = 4 + 2 + C = 10 \Rightarrow C = 4$$

$$\Rightarrow f(x) = x^2 + x + 4$$

#64 page 32x

$$\frac{dc}{dx} = \frac{1}{50}x + 10$$

$$x = 0 \Rightarrow$$

$$C = \$1000$$

$$\Rightarrow C = \frac{1}{50} \frac{x^2}{2} + 10x + k$$

$$C(0) = 1000$$

$$\Rightarrow C(x) = \frac{x^2}{100} + 10x + 1000$$

#67 page 32x

$$R(0) = 0$$

$$\frac{dR}{dx} = 225 - 3x$$

$$R = 225x - \frac{3x^2}{2} + k$$

$$R(0) = 0 \Rightarrow k = 0$$

$$\Rightarrow R(x) = 225x - \frac{3}{2}x^2$$

#72 page 328

(4)

$$\frac{dP}{dx} = -40x + 250 \quad P(5) = \$650$$

$$P = -40 \cdot \frac{x^2}{2} + 250x + k$$

$$P(5) = -40 \cdot \frac{25}{2} + 1250 + k$$

$$= -500 + 1250 + k = 650$$

$$k = 1050 - 1250$$

$$= -200$$

$$\Rightarrow P(x) = -20x^2 + 250x - 200$$

Section 5.2

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

①

#2 page 335

$u = 3-4x^2$

$\frac{du}{dx} = -8x$

check:

$$\left[ -\frac{2}{3} (3-x^3)^{3/2} \right]' =$$

$$= -\frac{2}{3} \cdot \frac{3}{2} (3-x^3)^{1/2} (-3x^2)$$

$$= (3x^2) \sqrt{3-x^3} \checkmark$$

#4 page 335

$u = x^3+1$

$\frac{du}{dx} = 3x^2$

#14 page 335

$$\int (x-3)^{1/2} dx = \frac{(x-3)^{3/2}}{3/2} + C$$

$$= \frac{2}{3} (x-3)^{3/2} + C$$

check

$$\left[ \frac{2}{3} (x-3)^{3/2} \right]' =$$

$$= \frac{2}{3} \cdot \frac{3}{2} (x-3)^{1/2} = (x-3)^{1/2} \checkmark$$

#16 page 335

$$\int x(1-2x^2)^3 dx =$$

$u = 1-2x^2$

$u' = -4x$

$$= -\frac{1}{4} \int (-4x)(1-2x^2)^3 dx$$

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

$$= -\frac{1}{16} (1-2x^2)^4 + C$$

#6 page 335

$u = 1+2x$

$du = 2$

#8 page 335

$u = 4-\sqrt{x}$

$\frac{du}{dx} = -\frac{1}{2\sqrt{x}}$

#10 page 335

$$\int (x^2-1)^3 (2x) dx = \int u^3 du$$

$u = x^2-1$

$\frac{du}{dx} = 2x$

$$= \frac{u^4}{4} + C = \frac{(x^2-1)^4}{4} + C$$

check:

$$\left[ \frac{(x^2-1)^4}{4} \right]' = \frac{1}{4} \cdot 4(x^2-1)^3 \cdot (2x) + C = 2x(x^2-1)^3 \checkmark$$

#12 page 335

$$\int \sqrt{3-x^3} (3x^2) dx = -\int u^{1/2} du$$

$u = 3-x^3$

$\frac{du}{dx} = -3x^2$

$$= -\frac{2}{3} u^{3/2} + C$$

check:

$$\left[-\frac{1}{16} (1-2x^2)^4\right]' =$$

$$= -\frac{1}{16} \cdot 4 (1-2x^2)^3 \cdot (-4x)$$

$$= x (1-2x^2)^3$$

# 18 page 335

$$\int \frac{x^2}{(x^3-1)^2} dx = \frac{1}{3} \int \frac{3x^2}{(x^3-1)^2} dx$$

$$u = x^3 - 1$$

$$\frac{du}{dx} = 3x^2$$

$$= \frac{1}{3} \int u' \cdot u^{-2} dx = \frac{1}{3} \int u^{-2} du$$

$$= \frac{1}{3} \frac{u^{-1}}{-1} + C$$

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

check:

$$\left[\frac{-1}{3(x^3-1)}\right]' = \left[-\frac{1}{3} (x^3-1)^{-1}\right]'$$

$$= -\frac{1}{3} (-1) (x^3-1)^{-2} \cdot 3x^2$$

$$= \frac{x^2}{(x^3-1)^2} \quad \checkmark$$

# 22 page 335

$$\int \frac{4x+6}{(x^2+3x+7)^3} dx = \dots$$

$$u = x^2 + 3x + 7$$

$$du = 2x + 3 dx$$

$$\dots = 2 \int u^{-3} du = 2 \cdot \frac{u^{-2}}{-2} + C$$

$$= \frac{-1}{(x^2+3x+7)^2} + C$$

check:

$$\left[\frac{-1}{(x^2+3x+7)^2}\right]' = (-1)(-2) \frac{2x+3}{(x^2+3x+7)^3}$$

$$= \frac{4x+6}{(x^2+3x+7)^3} \quad \checkmark$$

# 28 page 335

$$\int \frac{t + 2t^2}{\sqrt{t}} dt$$

$$= \int \frac{t}{\sqrt{t}} + 2 \frac{t^2}{\sqrt{t}} dt$$

$$= \int \sqrt{t} + 2t^{3/2} dt$$

$$= \frac{t^{3/2}}{3/2} + 2 \frac{t^{5/2}}{5/2} + C$$

$$= \frac{2}{3} t \sqrt{t} + \frac{4}{5} t^2 \sqrt{t} + C$$

check:

$$\left(\frac{2}{3} t \sqrt{t} + \frac{4}{5} t^2 \sqrt{t}\right)' = \left(\frac{2}{3} t^{3/2} + \frac{4}{5} t^{5/2}\right)'$$

$$= \frac{2}{3} \cdot \frac{3}{2} t^{1/2} + \frac{4}{5} \cdot \frac{5}{2} t^{3/2}$$

$$= (\sqrt{t} + 2t\sqrt{t}) \cdot \frac{\sqrt{t}}{\sqrt{t}}$$

$$= \frac{t + 2t^2}{\sqrt{t}}$$

# 36 page 336

$$\int x^2 (1-x^3)^2 dx = \dots$$

$$u = 1-x^3$$

$$du = -3x^2 dx$$

$$x^2 dx = \frac{du}{-3}$$

$$= \int \frac{u^2 du}{-3} = \frac{u^3}{-9} + C$$

$$= -\frac{1}{9} (1-x^3)^3 + C$$

# 38 page 336  $\int t \sqrt{t^2+1} dt$

$$u = t^2+1$$

$$du = 2t dt \Rightarrow t dt = \frac{du}{2}$$

$$= \int \sqrt{u} \cdot \frac{du}{2} = \frac{1}{2} \int u^{1/2} du$$

$$= \frac{1}{2} \frac{u^{3/2}}{3/2} + C = \frac{1}{3} u^{3/2} + C$$

$$= \frac{1}{3} (t^2+1) \sqrt{t^2+1} + C$$

# 39 page 336

$$\int \frac{x}{\sqrt{x^2+25}} dx =$$

$$u = x^2+25$$

$$du = 2x dx \Rightarrow x dx = \frac{du}{2}$$

$$= \int u^{-1/2} \cdot \frac{du}{2} = \frac{1}{2} \frac{u^{1/2}}{1/2} + C$$

$$= \sqrt{x^2+25} + C$$

3

# 42 page 336

$$\int \sqrt{x} (4-x^{3/2})^2 dx =$$

$$u = 4-x^{3/2}$$

$$du = -\frac{3}{2} x^{1/2} dx$$

$$\Rightarrow \sqrt{x} dx = -\frac{2}{3} du$$

$$= \int u^2 \cdot \left(-\frac{2}{3}\right) du = -\frac{2}{3} \frac{u^3}{3} + C$$

$$= -\frac{2}{9} (4-x^{3/2})^3 + C$$

# 46 page 336

$$(a) \int x (2x^2+1)^2 dx \quad \frac{I}{I}$$

$$= \int x (4x^4+4x^2+1) dx$$

$$= \int 4x^5 + 4x^3 + x dx$$

$$= \frac{4x^6}{6} + \frac{4x^4}{4} + \frac{x^2}{2} + C$$

$$= \frac{2x^6}{3} + x^4 + \frac{x^2}{2} + C$$

$$\frac{1}{4} \int 4x (2x^2+1)^2 dx \quad \frac{II}{II}$$

$$u = 2x^2+1$$

$$u' = 4x$$

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

$$= \frac{1}{12} (2x^2+1)^3 + C$$

(d) One answer is simplified and one is not.

(e) I prefer the second method since the answer is already factored.

# 55 page 336

$$\frac{dh}{dt} = \frac{17.6t}{\sqrt{17.6t^2 + 1}}$$

$$h(0) = 6$$

$$(a) h = \frac{1}{2} \int \frac{17.6t \cdot 2}{\sqrt{17.6t^2 + 1}} dt$$

$$= \frac{1}{2} \frac{(17.6t^2 + 1)^{\frac{1}{2}}}{\frac{1}{2}} + C$$

$$= \sqrt{17.6t^2 + 1} + C$$

$$h(0) = 6 \Rightarrow C = 5$$

$$\Rightarrow h(t) = \sqrt{17.6t^2 + 1} + 5$$

$$(b) h(5) = \sqrt{17.6 \cdot 25 + 1} + 5$$

$$= 26 \text{ in}$$