Review:

$f(x) = \cos x$

$x = 0$; $dx = 0.02$

approximate $\cos(0.02)$

$f(x+\Delta x) = f(x) + f'(x)(dx)$

$\cos(0+0.02) = \cos 0 + (-\sin 0)(0.02)$

$= \boxed{1}$

4.1 Antiderivatives

$F(x) = 5x^4$

$f(x) = x^5$ $\qquad [f(x)]' = 5x^4$

particular solution

General solution: $x^5 + C$

56. $g'(x) = 6x^2$, $g(0) = -1$

$y' = 6x^2$

$g(x) = 2x^3 + C$ ← general solution

$-1 = 0 + C$

$-1 = C$

particular solution: $g(x) = 2x^3 - 1$

$y = F(x)$

$\frac{dy}{dx} = f(x)$

antiderivative = indefinite integral

$\int dy = \int f(x)\,dx$

$y = \int f(x)\,dx = F(x) + C$

18. $\int (4x^3 + 6x^2 - 1)\,dx$

$= x^4 + 2x^3 - x + C$

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

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

$\int x^n\,dx = \frac{x^{n+1}}{n+1} + C$

$x^{-1} = \frac{1}{x}$

28. $\int \frac{x^2 + 2x - 3}{x^4}\,dx = \int \left(\frac{x^2}{x^4} + \frac{2x}{x^4} - \frac{3}{x^4}\right)dx$

$= \int (x^{-2} + 2x^{-3} - 3x^{-4})\,dx$

$= \boxed{-x^{-1} - x^{-2} + x^{-3} + C}$

38. $\int (\theta^2 + \sec^2\theta)\,d\theta$

$= \boxed{\frac{\theta^3}{3} + \tan\theta + C}$

42. $\int \frac{\cos x}{1-\cos^2 x}\,dx = \int \frac{\cos x}{\sin^2 x}\,dx$

$= \int \frac{\cos x}{\sin x} \cdot \frac{1}{\sin x}\,dx$

$= \int \csc x \cot x\,dx = \boxed{-\csc x + C}$

40. $\int \sec y(\tan y - \sec y)\,dy$

$= \int (\sec y \tan y - \sec^2 y)\,dy$

$= \boxed{\sec y - \tan y + C}$

58. $f'(s) = 6s - 8s^3$, $f(2) = 3$

$$\boxed{f(s) = 3s^2 - 2s^4 + C}$$ general solution

$$3 = 3(2)^2 - 2(2)^4 + C$$

$$3 = 12 - 32 + C$$

$$23 = C$$

particular solution: $\boxed{f(s) = 3s^2 - 2s^4 + 23}$

62. $f''(x) = \sin x$, $f'(0) = 1$, $f(0) = 6$

$$f'(x) = -\cos x + c_1$$

$$\boxed{f(x) = -\sin x + c_1 x + c_2}$$

general solution

$$1 = -\underset{1}{\cos(0)} + c_1 \qquad 6 = -\underset{0}{\sin(0)} + \cancel{c_1(0)} + c_2$$

$c_1 = 2$; $c_2 = 6$

particular solution: $\boxed{f(x) = -\sin x + 2x + 6}$

$s(t) = \text{position}$ $\quad s \quad m$

$v(t) = s'(t) = \text{velocity}$ $\quad \frac{\Delta s}{\Delta t} \quad m/s$

$a(t) = v'(t) = s''(t) = \text{acceleration}$

$\frac{\Delta s}{\Delta t} / \Delta t \quad m/s^2$

72. 1600 m $\quad a = -9.8\ m/s^2$

$a(t) = -9.8$

$v(t) = -9.8t + v_0$

$s(t) = -\frac{9.8}{2}t^2 + v_0 t + s_0$

$s(t) = -\frac{9.8}{2}t^2 + 1600$

$0 = -\frac{9.8}{2}t^2 + 1600$

$\sqrt{\frac{3200}{9.8}}\ s = t$

80. $a(t) = \cos t$, $t > 0$

@ $t = 0$; position is $x = 3$ $s(0)=3$

$v(0) = 0$

a) find velocity & position functions

b) find value(s) of t for which the particle is at rest.

$v(t) = \sin t + C_1$

$0 = \sin(0) + C_1$

$C_1 = 0$

$\boxed{v(t) = \sin t}$

$s(t) = -\cos t + C_2$

$3 = -\cos(0) + C_2$

$4 = C_2$

$\boxed{s(t) = -\cos t + 4}$

$v(t) = 0$

$-\sin t = 0$

$\sin t = 0$

$t = 0, \pi, 2\pi, 3\pi, \ldots$

$t = k\pi$, $k \geq 0$ integer

4.1 HW

5-33 odd

55-61 odd

67, 83