AP Calculus Homework Answer Keys

Homework 1

1. N/A

2. (a) -6 (b) 2   (c) DNE

3. (a) DNE   (c) $-1/16$ (e) $-4/5$
   (b) $1/2$ (d) $-1/9$

4. N/A

5. (a) DNE   (b) -4

6. (a) 3   (d) 1   (g) $49/121$
   (b) 3   (e) $3/8$
   (c) 4   (f) 0

7. (a) ∞ (b) $-\infty$ (c) $-\infty$

8. Vertical asymptotes at $x = 0$ and $x = 3/2$.

9. N/A

10. (a) $1/3$ (c) $-\infty$ (e) 0
    (b) -1 (d) $-1/2$

11. Horizontal Asymptote at $x \to \infty$.
    Vertical Asymptotes at $x = 0$ and $x = \pm 1$.

Homework 2

1. (a) 1 (b) 1/2

2. (a) $y = x - 1$ (b) $y = 2x - 2$

3. N/A

4. N/A

5. N/A

6. (a) 7/3 (b) 1

Homework 3

1. (a) $f(x) = 2^x$ (b) $f(x) = \tan x$

2. (a) $f'(5) = 1$ (b) $f'(5) = -26/25$

3. (a) $3x^2 - 4$

   (b) $4x - 1$

   (c) $-3t^{-8/5}$

   (d) $\frac{1}{2\sqrt{x}} - 2e^x$

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

   (f) $\frac{3}{2}x^{1/2} + 2x^{-1/2} - \frac{3}{2}x^{-3/2}$

   (g) $1 + \frac{1}{2x^{3/2}}$

   (h) $\frac{1}{5}t^{-4/5} + 10t^{3/2}$

   (i) $1 - \frac{1}{3}x^{-5/6} - \frac{2}{3}x^{-5/3}$

   (j) $-10Ay^{-11} + Be^y$

   (k) e^{x+1}

4. N/A

5. $c = 6$

6. (a) $e^x(x^3 + 3x^2 + 2x + 2)$

   (b) $\dfrac{xe^x}{(1+x)^2}$

   (c) $\dfrac{8 - 2t^2}{(4+t^2)^2}$

   (d) $14x^6 - 4x^3 - 6$

   (e) $(1 + e^t)(3 - \sqrt{t}) + (t + e^t)\left(-\dfrac{1}{2\sqrt{t}}\right)$

   (f) $\dfrac{-2x^3 - 3x^2 - 3}{(x^3 + x - 2)^2}$

   (g) $\dfrac{-2t^5 - 8t^3 + 14}{(t^4 - 3t^2 + 1)^2}$

   (h) $e^r(r^2 - 2)$

   (i) $\dfrac{3}{2}w^{1/2}(w + ce^w) + w^{3/2}(1 + ce^w)$

   (j) $\dfrac{4 + \sqrt{t}}{(2 + \sqrt{t})^2}$

Homework 4

1. (a) $e^u \left(\cos u - \sin u + c(1 + u) \right)$

   (b) $\dfrac{x \cos x - 2 \sin x}{x^3}$

   (c) $e^x \csc x \left((4 + x) - x \cot x \right)$

   (d) $x \tan^{-1} x$

2. $y = 3\sqrt{3}x - \pi\sqrt{3} + 1$

3. (a) $\dfrac{-12t^3}{(t^4 + 1)^4}$

   (b) $e^{-kx}(1 - kx)$

   (c) $\dfrac{2x(4x^2 + 7)}{3(x^2 + 2)^{2/3}}$

   (d) $-e^{-5x}(\cos 3x + 3\sin 3x)$

   (e) $2\cos(\tan 2x)(\sec^2 2x)$

   (f) $2x \cdot 2^{3^{x^2}} \cdot 3^{x^2} \cdot 3^{x^2} \cdot \ln 2 \ln 3$

   (g) $4\left[x + \left(x + \sin^2 x \right) \right]^3 \left(1 + 3\left(x + \sin^2 x \right)^2 \right)(1 + 2\sin x \cos x)$

4. $y = 20x + 1$

5. $F'(1) = 198$

6. $f'(x) = -\dfrac{1 + \dfrac{2 + 2\cos x}{(x + \sin x)^2}}{\left(x - \dfrac{2}{x + \sin x} \right)^2}$

7. (a) $\dfrac{dy}{dx} = \dfrac{2xye^{x^2} - 2xy^3}{5y^4 + 3x^2y - e^{x^2}}$

   (b) $\dfrac{dy}{dx} = \dfrac{\sin(y^2) - 2xy\cos(x^2)}{\sin(x^2) - 2xy\cos(y^2)}$

   (c) $\dfrac{dy}{dx} = \dfrac{4xy\sqrt{xy} - y}{2x^2\sqrt{xy}}$

8. $y = x + \dfrac{1}{2}$

9. (a) $\dfrac{x \sec^{-1} x}{\sqrt{x^2 - 1}} + \dfrac{1}{x}$

(b) 0

(c) $\dfrac{1}{2} \dfrac{\cos \theta}{\sqrt{\sin \theta - \sin^2 \theta}}$

10. $ce^{cx}(2 + cx)$

11. $f''(x) = 6xg'(x^2) + 4x^3 g''(x^2)$

12. A

13. C

14. D

15. B

Homework 5

See attached file.

Homework 6

1. N/A

2. (a) $x = 2$, $x = 4$

   (b) $t = \dfrac{4}{3}$

   (c) $y = 0$, $y = 2$

   (d) $x = 0$, $x = \pm 1$

   (e) $x = 0$

   (f) $\theta = 2n\pi \pm \frac{2\pi}{3}$, $\cos\theta \neq 0$

   (g) $x = 0$, $x = \frac{2}{3}$

   (h) $x = \sqrt{e}$

3. (a) min : $f(2) = -7$, max : $f(0) = 5$

   (b) min : $f(0) = -1$, max : $f(2) = 27$

   (c) min : $f(0) = 0$, max : $f(1) = \frac{1}{2}$

   (d) min : $f(0) = f(8) = 0$, max : $f(2) = 6\sqrt[3]{2}$

   (e) min : $f\left(\frac{\pi}{2}\right) = 0$, max : $f(\frac{\pi}{6}) = \frac{3\sqrt{3}}{2}$

   (f) min : $f(-1) = -e^{-\frac{1}{8}}$, max : $f(2) = 2e^{-\frac{1}{2}}$

   (g) min : $f\left(-\frac{1}{2}\right) = \ln\frac{3}{4}$, max : $f(1) = \ln 3$

4. N/A

5. $c = -\dfrac{1}{2}\ln\left(\dfrac{1 - e^{-6}}{6}\right)$

6. The smallest possible value of $f(4)$ is 16

7. N/A

8. A

9. D

10. C

Homework 7

See attached file.

Homework 8

Practice Test 1

Homework 9

1. (a) $F(x) = 4x^{3/2} - \dfrac{6}{7}x^{7/6} + C$

   (b) $G(\theta) = \sin\theta + 5\cos\theta + C$

   (c) $F(x) = \dfrac{4}{3}x^{3/2} + 6\sin x + C$

2. (a) $f(x) + 4x^{3/2} + 2x^{5/2} + 4$

   (b) $f(x) = x^2 + x^{-3} + 1$

   (c) $f(t) = 2e^t - 3\sin 6 - 14.09t - 2$, where $14.09 = \dfrac{2 - 2e^\pi}{\pi}$

   (d) $f(t) = -\ln x + x\ln 2 - \ln 2$

3. 225 ft

4. At least $-62,500\ km/h^2$

5. (a) $\displaystyle\int_2^6 x\ln\left(1 + x^2\right)\,dx$ (b) $\displaystyle\int_1^8 \sqrt{2x + x^2}\,dx$

6. (a) $g'(x) = \dfrac{1}{x^3+1}$

   (b) $F'(x) = -\sqrt{1 + \sec x}$

   (c) $G'(x) = -\cos\sqrt{x}$

7. (a) $\left[5t - t^2 + t^3\right]_1^4 = 63$

   (b) $\left[\dfrac{3}{4}x^{4/3}\right]_1^8 = \dfrac{45}{4}$

   (c) $\left[\sin\theta\right]_\pi^{2\pi} = 0$

   (d) $\left[\dfrac{2}{3}x^{3/2} - 2x^{1/2}\right]_1^9 = \dfrac{40}{3}$

   (e) $\left[\sec\theta\right]_0^{\pi/4} = \sqrt{2} - 1$

   (f) $\left[\dfrac{4}{3}y^3 - 2y^2 + y\right]_1^2 = \dfrac{49}{3}$

   (g) $\left[\dfrac{1}{2}\ln x\right]_1^9 = \ln 3$

   (h) $e\left[e^u\right]_{-1}^1 = e^2 - 1$

   (i) $\left[-2u^{-2} + \ln u\right]_1^2 = \dfrac{3}{2} + \ln 2$

8. $f(4) = 29$

Homework 10

1. (a) $\dfrac{x^3}{3} - 4x^{1/2} + c$

   (b) $\tan\alpha + c$

   (c) $2\sin x + c$

2. (a) 52

   (b) $-\dfrac{63}{4}$

   (c) $2\sqrt{5}$

   (d) $2 - \sqrt{2}$

   (e) $1 + \dfrac{\pi}{4}$

   (f) $\dfrac{\pi}{6}$

   (g) $-\dfrac{7}{2}$

3. (a) $-\dfrac{10}{3}$ meters

   (b) $\dfrac{98}{3}$ meters

4. (a) $v(t) = t^2 + 3t - 4$

   (b) $\frac{89}{6}$

5. (a) $2\sin\sqrt{t} + C$

   (b) $\frac{1}{2}\left(z^3 + 1\right)^{2/3} + C$

   (c) $e^{\tan x} + C$

   (d) $-\cos(\ln x) + C$

   (e) $-\ln\left(1 + \cos^2 x\right) + C$

   (f) $2\sqrt{1 + \tan t} + C$

   (g) $\tan^{-1} + \frac{1}{2}\ln\left(1 + x^2\right) + C$

   (h) $\frac{4}{7}(x + 2)^{7/4} - \frac{8}{3}(x + 2)^{3/4} + C$

6. (a) $\frac{182}{9}$

   (b) 4

   (c) $e - \sqrt{e}$

   (d) 2

   (e) $\frac{\pi^2}{72}$

7. 2

Homework 11

1. (a) $-\dfrac{x^2}{\pi}\cos\pi x + \dfrac{2x}{\pi^2}\sin\pi x + \dfrac{2}{\pi^3}\cos\pi x + C$

   (b) $x(\ln x)^2 - 2x\ln x + 2x + C$

   (c) $\dfrac{2}{13}\sin 3\theta e^{2\theta} - \dfrac{3}{13}\cos 3\theta e^{2\theta} + C$

   (d) $3 - \dfrac{6}{e}$

   (e) $6\ln 9 - 4\ln 4 - 4$

   (f) $\dfrac{1}{4} - \dfrac{3}{4e^2}$

   (g) $\left[\dfrac{2\sqrt{3}-3}{12}\right]\pi + \dfrac{1}{2}\ln 2$

   (h) $\sin x\,(\ln(\sin x) - 1) + C$

   (i) $\dfrac{16 - 7\sqrt{5}}{3}$

   (j) $\dfrac{1}{2}(e^t - \sin t - \cos t)$

2. N/A

3. 2

4. E

5. A

Homework 12

1. (a) $\dfrac{2\cos^3\left(\sqrt{x}\right)}{3} - 2\cos\left(\sqrt{x}\right) + C$

   (b) $\dfrac{1}{4}x^2 + \dfrac{1}{4}x\sin 2x + \dfrac{1}{8}\cos 2x + C$

   (c) $\dfrac{1}{2}\cos^2 x - \ln|\cos x| + C$

   (d) $-\dfrac{1}{2}\cos^4 x + C$

   (e) $\tan x - x + C$

   (f) $\dfrac{117}{8}$

   (g) $x\sec x - \ln|\sec x + \tan x| + C$

2. $f(t) = \dfrac{1 - \cos^3 \omega t}{3w}$

3. (a) $\ln\left(\dfrac{(x+5)^2}{|x-2|}\right) + C$

   (b) $-\dfrac{1}{5}\ln|t+4| + \dfrac{1}{5}\ln|t-1| + C$

   (c) $3\ln 3 - 5\ln 2$

4. A

5. D

Homework 13

1. (a) $\dfrac{7}{6} + \ln \dfrac{2}{3}$

   (b) $-\dfrac{1}{36}\ln|x+5| + \dfrac{1}{6(x+5)} + \dfrac{1}{36}\ln|x-1| + C$

   (c) $\dfrac{1}{2}x^2 - 2\ln|x^2+4| + \tan^{-1}\left(\dfrac{x}{2}\right) + C$

   (d) $2\ln|x| - \dfrac{1}{2}\ln|x^2+3| - \dfrac{1}{\sqrt{3}}\tan^{-1}\left(\dfrac{x}{\sqrt{3}}\right) + C$

   (e) $\dfrac{1}{3}\ln|x-1| - \dfrac{1}{6}\ln|x^2+x+1| - \dfrac{1}{\sqrt{3}}\tan^{-1}\left(\dfrac{2x+1}{\sqrt{3}}\right) + C$

2. (a) $\frac{1}{12}$ (e) 0

   (b) Divergent

   (c) Divergent   (f) Divergent

   (d) Divergent   (g) Divergent

3. A

4. C

5. C

Homework 14

1. (a) Converges to 2
    (b) Converges to $\frac{32}{3}$
    (c) Divergent
    (d) Divergent

    (e) Converges to $-2e^{-1}$
    (f) Converges to $\frac{8}{3}\ln 2 - \frac{8}{9}$
    (g) Converges to -4

2. (a) $e^{\frac{\pi}{2}} - 2$
    (b) $\frac{1}{6}$
    (c) $\ln 2 - \frac{1}{2}$

    (d) $2 - \ln 2$
    (e) $\frac{59}{12}$

3. $\dfrac{13}{2}$

4. $\dfrac{3}{2}\sqrt{3} - 1$

5. $c = \pm 6$

6. D

7. D

Homework 15

1. (a) $\dfrac{32}{3}$ (b) $\dfrac{8}{3}$

2. (a) $\dfrac{19}{12}\pi$ (d) $\dfrac{4}{21}\pi$

   (b) $\dfrac{16}{15}\pi$ (e) $\dfrac{176}{3}\pi$

   (c) $\dfrac{\pi}{2}$

3. C

4. E

5. C

Homework 16

1. (a) 162π

   (b) $\dfrac{\pi e^2}{2}\left(e^2 - 1\right)$

   (c) $\dfrac{64}{15}\pi$

   (d) $\dfrac{\pi}{6}$

   (e) $\pi\left[\dfrac{2}{3} + 2\ln 3\right]$

   (f) $\dfrac{29}{30}\pi$

2. (a) $\dfrac{45}{28}$

   (b) $-\dfrac{1}{10}\left(e^{-25} - 1\right)$

   (c) $\dfrac{2}{5\pi}$

3. N/A

4. (a) $\dfrac{2\left(82\sqrt{82} - 1\right)}{243} \approx 6.103$

   (b) $\dfrac{1261}{240}$

   (c) $\dfrac{32}{3}$

   (d) $\ln\left(2 + \sqrt{3}\right)$

   (e) 2

5. $L = \sqrt{2} + \ln\left(\sqrt{2} + 1\right)$

6. $L = \dfrac{2\left(1 + 9x\right)^{3/2} - 20\sqrt{10}}{27}$

7. C

8. A

Homework 17

Practice Test 2

Homework 18

1. N/A

2. N/A

3. (d) is the solution.

4. (a) $y = \ln\left(\frac{2}{3}x^{3/2} + C\right)$

   (b) $y = C\sqrt{x^2 + 1}$

   (c) $u + \frac{2}{3}u^{3/2} = r + \frac{2}{3}r^{3/2} + C$

   (d) $-ye^{-y} - e^{-y} = \frac{1}{3}\sin^3\theta + C$

   (e) $u = Ce^{\frac{1}{2}t + 2t} - 1$, $C = \pm e^c$

5. (a) $\frac{1}{2}y^2 + \ln|y| = \sin x + \frac{1}{2}$

   (b) $y^2 + \frac{1}{3}e^3 y = x\sin x + \cos x - \frac{2}{3}$

   (c) $y = \frac{1}{1 - 2x}$

6. $y = e^{\frac{1}{2}x^2}$

7. $f(x) = \frac{e^x}{1 + e^x}$