June 09

1. (a) $\dfrac{1}{2r} - \dfrac{1}{2(r+2)}$

2. $z = 2\left(\cos\left(-\dfrac{\pi}{12}\right) + i\sin\left(-\dfrac{\pi}{12}\right)\right)$, $2\left(\cos\dfrac{7\pi}{12} + i\sin\left(\dfrac{7\pi}{12}\right)\right)$

   and $z = 2\left(\cos\left(\dfrac{-3\pi}{4}\right) + i\sin\left(\dfrac{-3\pi}{4}\right)\right)$

3. $y = 2\sin^2 x + K\sin x$

4. $a = 7$

5. (b) $\left\{\sec x \approx 2 + 4\left(x - \tfrac{\pi}{4}\right) + 8\left(x - \tfrac{\pi}{4}\right)^2 + \tfrac{40}{3}\left(x - \tfrac{\pi}{4}\right)^3 + \ldots\right\}$

6. (a) centre $\left(\tfrac{9}{8}, 0\right)$, radius $\tfrac{3}{8}$

7. (b) $x = 0, 1$ (c) $0 < x < 1$

8. (a) $x = -e^{-3t} + e^{-t}$

June 10

1. (a) $\dfrac{1}{3r-1} - \dfrac{1}{3r+2}$ (c) 0.00301

2. $0.5t - 0.5t^2 - \tfrac{1}{12}t^3 + \ldots$

3. (a) $-5 < x < -3$ (b) $x > -2$

4. (a) 16, $\dfrac{2\pi}{3}$ (b) 4096

   (c) $w = \sqrt{3} + i$ $-1 + \sqrt{3}i$ or $-\sqrt{3} - i$ or $1 - \sqrt{3}i$

5. (a) $\left(2, \dfrac{\pi}{18}\right)$, $\left(2, \dfrac{5\pi}{18}\right)$ (b) $\dfrac{13\sqrt{3}}{24} - \dfrac{5\pi}{36}$

6. (b) $3 + 9i$, $3 - i$ (c) $(u-5)^2 + v^2 = 25$

7. (b) $z = \tfrac{1}{2}\tan x + \tfrac{1}{2}x\sec^2 x + c\sec^2 x$

   (b) $y = (\tfrac{1}{2}\tan x + \tfrac{1}{2}x\sec^2 x + c\sec^2 x)^2$

8. (a) $\lambda = \dfrac{3}{10}$ (b) $y = A\cos 5x + B\sin 5x + \dfrac{3}{10}x\sin 5x$

   (c) $y = \sin 5x + \dfrac{3}{10}x\sin 5x$

June 11

1. $-3 < x < -2$, $0 < x < 6$

2. (a) $k = 4$ (b) $y = 1 + 2x + 3x^2 + 5x^3$

3. $y = \dfrac{\ln x}{4x} - \dfrac{1}{16x} + \dfrac{C}{x^5}$

4. (a) $A = 8$, $b = 12$, $C = 6$

5. (a) $x^2 + (y-1)^2 = 4$

6. $R = \dfrac{3\pi}{4} + \dfrac{9\sqrt{3}}{32}$

7. (b) 1.095, 2.046, 4.237, 5.188

8. (a) $x = (A + Bt)e^{-3t} + \dfrac{1}{18}\sin 3t$ (b) $x = \left(\dfrac{1}{2} + \dfrac{4t}{3}\right)e^{-3t} + \dfrac{1}{18}\sin 3t$

   (c) $t \approx \dfrac{59\pi}{6}$, $x \approx \dfrac{1}{18}$

June 12

1. $x > 1$, $x < 4$

2. $\dfrac{3 + \sqrt{33}}{4}$

3. (a) $4(\cos\dfrac{2\pi}{3} + i\sin\dfrac{2\pi}{3})$

   (b) $\sqrt{2}(\cos\theta + i\sin\theta)$ where $\theta = -\dfrac{5\pi}{6}, -\dfrac{\pi}{3}, \dfrac{\pi}{6}, \dfrac{2\pi}{3}$

4. $x = Ae^{-2t} + Be^{-3t} + \dfrac{3}{10}\cos t + \dfrac{3}{10}\sin t$

5. (b) $y = 1 + 4(x-1) + \dfrac{7}{2}(x-1)^2 + \dfrac{16}{3}(x-1)^3$

6. (a) $\dfrac{1}{2r} + \dfrac{1}{2r+4}$ (b) $a = 3$, $b = 5$

7. (b) $y = \sqrt[3]{\dfrac{x^3 - Bx}{2}}$ (c) $\dfrac{3}{4}$

8. (c) $(4 - \sqrt{10}) + i(-2 - \sqrt{10})$

June 13

1. (a) $\dfrac{1}{2r+1}+\dfrac{1}{2r+3}$ (b) $\dfrac{n}{2n+3}$

2. (a) 10 (b) $-\dfrac{\pi}{6}$ (c) $\dfrac{1}{5}$ (d) $\dfrac{5\pi}{12}$

3. $y=\dfrac{1}{2}+\dfrac{x}{8}-x^2+\dfrac{x^3}{12}$

4. (b) $w^5=243\left(\dfrac{1}{\sqrt{2}}-\dfrac{1}{\sqrt{2}}i\right)$

5. (a) $y=x^2+\dfrac{c}{x^2}$ (b) $y=x^2+\dfrac{4}{x^2}$ $(c)(i)$ $x=\pm\sqrt{2}, y=4$

6. (a) $x=0$ or $x=-2$ (c) $x<-5, -2<x<0, x>1$

7. (b) $v=C\cos x+D\sin x+\dfrac{1}{4}x$ (c) $y=x\left(C\cos x+D\sin x+\dfrac{1}{4}x\right)$

8. (b) $R=2a\dfrac{\sqrt{2}}{3}$

June 13 (R)

1. $v+1=0$

2. $-\dfrac{3}{2}<x<-1, \dfrac{1}{3}<x<3$

3. (a) $\dfrac{1}{r+1}-\dfrac{1}{r+3}$ (c) 0.155

4. (a) $\dfrac{d^3y}{dx^3}=\dfrac{-5\dfrac{dy}{dx}-3\left(\dfrac{dy}{dx}\right)\dfrac{d^2y}{dx^2}}{y}$ (b) $y=2+2x-\dfrac{7}{2}x^2+\dfrac{8}{3}x^3$

5. (a) $y=\dfrac{2\ln\sec x+c}{\sec^2 x}$ (b) $6-\dfrac{3}{4}\ln 3$

6. (c) $\theta=\dfrac{\pi}{2},\dfrac{3\pi}{2}$

7. (a) $\lambda=3$ (b) $y=(A+Bt)e^{3t}+3t^2e^{3t}$ (c) $y=(5-11t)e^{3t}+3t^2e^{3t}$

8. (a) 9 (b) $9\sqrt{2}-9$

June 14

1. (a) $\dfrac{1}{r+2}+\dfrac{1}{r+4}$

2. $1<x<2$ $\dfrac{11}{3}<x<6$

3. $y=3+\dfrac{1}{6}x+\dfrac{17}{216}x^2$

4. (b) $\dfrac{\pi}{18}$ $\dfrac{5\pi}{18}$ $\dfrac{7\pi}{18}$

5. (a) $y=e^{-x}(A\cos 3x+B\sin 3x+3)$ (b) $y=e^{-x}(3-3\cos 3x)$

7. (b) $y^3=\dfrac{1}{cx^3-6x^4}$

8. (a) $\theta=\dfrac{\pi}{4}, r=2$ (b) $R=\dfrac{1}{2}\{\ln 2+\sqrt{3}-1\}$

June 14 (R)

1. $\dfrac{1}{2r-1}-\dfrac{1}{2r+1}$

2. $x<-\dfrac{1}{3}, 0<x<2$

3. (a) $y=\left(\dfrac{1}{4}e^{4x}+c\right)\cos^2 x$ (b) $y=\dfrac{1}{4}\left(e^{4x}+3\right)\cos^2 x$

4. $r=\dfrac{2\sqrt{6}}{9}\csc\theta$ $(0<\theta<\pi)$

5. (a) $\dfrac{d^3y}{dx^3}=\dfrac{1}{y}\left(-5\dfrac{d^2y}{dx^2}-2\right)\dfrac{dy}{dx}$ (b) $y=2+\dfrac{1}{2}x-\dfrac{9}{8}x^2+\dfrac{37}{96}x^3+...$

6. (a) $y=1$

7. (b) $\sin\theta=0.669, 0.914, -0.105, -0.5, -0.978$ (c) $\dfrac{13\sqrt{2}}{20}-\dfrac{6}{5}$

8. (a) $\dfrac{d^2y}{dz^2}+\dfrac{dy}{dz}-2y=3z$ (b) $y=Ae^{-2z}+Be^z-\dfrac{3}{2}z-\dfrac{3}{4}$

    (c) $y=Ax^{-2}+Bx-\dfrac{3}{2}\ln x-\dfrac{3}{4}$