Answers to Last AP Review

1. (a) 18,000. The solution curve is increasing on $0 < P < 18{,}000$ because $\frac{dP}{dt} > 0$.

   (b) 18,000. The solution curve is increasing on $0 < P < 18{,}000$ because $\frac{dP}{dt} > 0$.

   (c) 18,000. The solution curve is decreasing on $P > 18{,}000$ because $\frac{dP}{dt} < 0$.

   (d) 9000. $\frac{d^2P}{dt^2} = 3\frac{dP}{dt} - \frac{1}{3000}P\frac{dP}{dt} = \frac{1}{3000}\frac{dP}{dt}(9000 - P) = 0$ when $P = 9000$.

   When $0 < P < 9000$, $\frac{d^2P}{dt^2} > 0$. When $9000 < P < 18{,}000$, $\frac{d^2P}{dt^2} < 0$. Therefore the solution curve is concave up for $0 < P < 9000$ and concave down for $9000 < P < 18{,}000$ and has an inflection point when $P = 9000$.

2. $-\frac{1}{2}x\cos(2x) + \frac{1}{4}\sin(2x) + C$
3. $\frac{1}{2}\ln\left|\frac{x-4}{x-2}\right| + C$
4. $A = \frac{1}{2}\int_{-\pi/3}^{\pi/3}\left(16\cos^2\theta - 4\right)d\theta$
5. 3.015
6. (a) 2.275
   (b) 1.458
   (c) (3.954, 4.906)
7. (a) $\frac{2}{9}$
   (b) $\frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \ldots + \frac{1}{3^{n+1}} + \ldots$
   (c) $\frac{1}{2}$
8. $-\frac{1}{2}$
9. 12 units/min
10. $\int_0^{\pi/2}\sqrt{9\cos^4 t\sin^2 t + 9\sin^4 t\cos t}\, dt$
11. $-\frac{1}{42}$
12. $y = 5e^{\tan x}$
13. -1
14. $\frac{4}{3}$
15. $-1 \le x < 5$
16. B
17. (a) $5 - 3(x-2) + \frac{4(x-2)^2}{2!} - \frac{(x-2)^3}{3!}$
    (b) 4.59444
    (c) Since $4.59437 < x < 4.59450$, $f(2.15) \neq 4.7$.
18. This is an alternating series whose terms are decreasing so the error in approximating $f(6)$ with the sixth-degree polynomial is less in size than the first truncated term, which is $\frac{1}{1152}$ by the Alternating Series Remainder.

    $f(6) = \frac{1}{2} - \frac{1}{6} + \frac{1}{16} - \frac{1}{40} + \frac{1}{96} - \frac{1}{224} + \frac{1}{512} - \frac{1}{1152} + \ldots$