



5. (20 pts) Let  $g(x) = \arctan x^2$ .
- Find a Maclaurin series for  $g(x)$ .
  - Use your answer for part (a) to find a Maclaurin series for  $x^3g(x)$ . Simplify your answer.
  - What is the sum of the series found in part (b)?
6. (14 pts) Consider the parametric curve  $x = e^{t/2}$ ,  $y = 1 + e^{2t}$ .
- Find an equation of the line with slope 4 that is tangent to the curve.
  - Eliminate the parameter to find a Cartesian equation of the curve. Simplify your answer.
7. (14 pts) Consider the curve  $x^2 = 16(1 + y^2)$ .
- Find the vertices and asymptotes of the curve.
  - Find a polar representation  $r = f(\theta)$  for the curve.
8. (20 pts) Consider the polar curves  $r = 2 + \sin(2\theta)$  and  $r = 2 + \cos(2\theta)$  in the 1st and 2nd quadrants, shown at right.
- Find the  $(x, y)$  coordinates for the point that corresponds to  $r = 2 + \sin(2\theta)$ ,  $\theta = \frac{\pi}{6}$ . Simplify your answer.
  - Set up (but do not evaluate) integrals to find the following quantities.
    - Length of the curve  $r = 2 + \sin(2\theta)$ .
    - Area of the region inside  $r = 2 + \sin(2\theta)$  and outside  $r = 2 + \cos(2\theta)$ . *Hint:* For the bounds, consider  $\tan(2\theta)$ .

