Answers to Math 124 Autumn 2021 Final

1. (a) $-\dfrac{1}{16}$

   (b) $\dfrac{1}{6}$

   (c) $f'(x) = -\dfrac{3}{(x-3)^2}$ (required computation with $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$)

2. (a) $f'(x) = \dfrac{(3x^2-2x)e^{3x-1} - (x^3-x^2+1)\cdot e^{3x-1}\cdot 3}{(e^{3x-1})^2}$

   (b) $f'(x) = \dfrac{\cos(\ln x)}{x \cdot \sin(\ln x)}$

   (c) $y' = \left(\dfrac{\ln\sqrt{x}}{2\sqrt{x}} + \dfrac{1}{2\sqrt{x}}\right)\sqrt{x}^{\sqrt{x}}$

3. (a) DNE (b) -3 (c) ∞ (d) $3/5$ (e) $-11, -8, -7, -5, 4, 8$
   (f) $(-11,-10)$, $(-10,-8)$, $(-5,4)$ (g) $(-10,-7)$, $(2,8)$ (h) -2

4. (a) 1.0125 (b) $y'' > 0$, it is concave up and increasing so LA gives an underestimate

5. $\left(\dfrac{65}{16}, -\dfrac{249}{64}\right)$

6. $\dfrac{d\theta}{dt} = -\dfrac{3+2\sqrt{2}}{10}$

7. $2\pi\sqrt{3}$ cubic inches

8. (a) $(0,3)$ is the y-intercept. $(1,0)$ and $(3,0)$ are the x-intercepts.

   (b) There are no vertical asymptotes. The line $y = 3$ is a horizontal asymptote in both the positive and negative directions.

   (c) $x = \sqrt{3}$ gives a local minimum. $x = -\sqrt{3}$ gives a local maximum.

   (d) The inflection points are $(-3,6)$, $(0,3)$, and $(3,0)$. The graph is concave down on the intervals $(-3,0)$ and $(3,\infty)$.

   (e) Graph with labeled points: