# MA 231 Practice Exam 2

1. Find $y'(1)$ if $y = 2(4x^3 - x)(x - 1)$.

   **Answer**: 6.

2. Find $\left.\dfrac{\mathrm{d}y}{\mathrm{d}x}\right|_{x=\pi}$ if $y = \dfrac{x\cos x}{1+\sin x}$.

   **Answer**: $-1 - \pi$.

3. Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ if $y = \left(\frac{3x-4}{5x+3}\right)^4$.

**Answer**: $\frac{116(3x-4)^3}{(5x+3)^5}$.

4. Find $f'(0)$ if $f(x) = (4+x^2)^5 \tan x$.

**Answer**: $1024$.

5. Let $f(u) = \dfrac{u+1}{u-1}$, and $g(x) = x^2$. Find $(f \circ g)'(2)$.

   **Answer**: $-\frac{8}{9}$.

6. The population $P$, in thousands, of a small city is given by

$$P(t) = 10 + \frac{5t}{t^2+16},$$

   where $t$ is the time, in years. The derivative of $P(t)$ is

$$P'(t) = \frac{-5t^2+80}{(t^2+16)^2}.$$

   Find the growth rate at $t = 2$ year.

   **Answer**: 0.15 thansands per year.

7. The position of a moving object, in feet, after $t$ seconds, is given by

$$s(t) = \sec t + \cos t.$$

Find the acceleration of the object at $t = \frac{\pi}{3}$.

**Answer**: $\frac{27}{2}\ ft/s^2$.

8. Find the slope of the line tangent to the curve $y = x^2\sqrt{(2x+1)}$ passing through the point $(4, 48)$.

**Answer**: $\frac{88}{3}$.

9. The domain of $f(x)$ is all real numbers, and its first derivative is $f'(x) = \dfrac{x^2 - 4}{(x-1)^2 + 1}$. Find the number of critical points of $f(x)$.

**Answer**: 2.

10. The first derivative of $f(x) = 12 - 72x^2 + 4x^3 + 3x^4$ is $f'(x) = -144x + 12x^2 + 12x^3$. Find the relative extrema of $f(x)$ if they exist. You only need to list the x-coordinates if they exist.

**Answer**: relative max at $x = 0$, relative min at $x = -4$ and $x = 3$.

11. Find the inflection points of $f(x) = 125 + 20x^4 - 3x^5$ if they exist. You only need to list the x-coordinates if they exist.

**Answer**: $x = 4$.

12. How many of the following statements are true?

a. If $f''(x) > 0$ on an interval $I$, then $f$ is increasing on that interval.
b. If $f''(x) = 0$ at $x = c$, then $(c, f(c))$ is an inflection point of $f(x)$.
c. If $f(x)$ has a critical point at $x = c$, then $f(x)$ changes from increasing to decreasing, or from decreasing to increasing at $x = c$.

**Answer**: 0.