1. (2 pts) According to the 2010 USA Today survey\(^1\) of Major League Baseball salaries, the Cincinnati Reds had a mean salary of $2,760,059 and a median salary of $485,000.

According to the 2009 Bureau of Labor Statistics\(^2\) survey of US middle school teacher salaries, the mean salary is $53,550 and the median salary is $50,770.

Explain in a few complete sentence or two what this information says about the differences in the salary distributions of Cincinnati Reds baseball players and US middle school teachers.

Firstly, why are we paying people 10 times as much money to play a game than to promote the better future of our country!??

Anyway, the mean and median for teacher salaries are very close together, indicating that there are few outliers (or at least as many below the median as above): everybody gets paid essentially the same amount. The mean and median for ballplayer salaries are quite different, indicating that most ballplayers make “essentially nothing” while a few outliers are making multi-millions to drive the mean salary much higher.

2. (3 pts) Let \( p(x) \) be the probability density function given by the formula

\[
p(x) = \begin{cases} 
\frac{x^3}{8} & \text{if } 0 \leq x \leq 2.4 \\
0 & \text{otherwise.} 
\end{cases}
\]

Find the exact value of the median of this distribution.

Median: Solve for \( T \) in \( \frac{1}{2} = \int_0^T \frac{1}{8} x^3 \, dx. \)

That is, \( \frac{1}{2} = \frac{T^4}{32}, \) or \( T = 2. \)

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\(^1\)See http://content.usatoday.com/sportsdata/baseball/mlb/salaries/team.

\(^2\)See http://www.bls.gov/oes/current/oes252022.htm#st
3. (2 pts) Let \( Q = f(x, t) \) be the quantity of pollutants, in ppm (parts per million), at a distance of \( x \) miles from a waste incinerator \( t \) hours after incineration ends. What does the statement \( f(1.5, 6) = 4.1 \) mean in practical terms? Use appropriate units.

At a distance of 1.5 miles from the waste plant, 6 hours after incineration ends, the proportion of pollutants in the air will be roughly 4.1 ppm.

4. (3 pts) Consider the function \( f(x, y) = x + xy^2 \).

Fill in the blanks with the letter of the phrase which correctly completes each sentence.

\( A = \) is always increasing.

\( B = \) is always decreasing.

\( C = \) is sometimes increasing and sometimes decreasing.

No explanations are required.

(a) Suppose \( y = y_0 \) is a fixed positive constant. Then, as a function of \( x \), \( h(x) = f(x, y_0) \).

\( \underline{A} \)

For example, if \( y_0 = 2 \), then \( h \) looks like the line \( 5x \)

(b) Suppose \( x = x_0 \) is a fixed positive constant. Then, as a function of \( y \), \( g(y) = f(x_0, y) \).

\( \underline{C} \)

For example, if \( x_0 = 1 \), then \( g \) looks like the line \( y^2 + 1 \)