1. [10 points] Indicate if each of the following statements are true or false by circling the correct answer. **You do not need to justify your answers.**

a. [2 points] The integral $\int_{-2}^{2} \frac{1}{x^2} dx = -1$

True $\boxed{\text{False}}$

Solution: $\int_{-2}^{2} \frac{1}{x^2} dx = 2\int_{0}^{2} \frac{1}{x^2} dx = \lim_{b \to 0^+} 2\int_{b}^{2} \frac{1}{x^2} dx = \lim_{b \to 0^+} \frac{-2}{x} \Big|_b^2 = \infty$ diverges.

b. [2 points] For any positive number p, the integral $\int_{0}^{\infty} \frac{1}{x^p} dx$ diverges.

$\boxed{\text{True}}$ False

Solution: $\int_{0}^{\infty} \frac{1}{x^p} dx = \int_{0}^{1} \frac{1}{x^p} dx + \int_{1}^{\infty} \frac{1}{x^p} dx$ The first integral diverges if $p \geq 1$ and the second diverges if $p \leq 1$. Hence the integral diverges for all values of p.

c. [2 points] If the median grade of an exam is larger than the average grade then more than half of the students got a grade greater or equal to the average.

$\boxed{\text{True}}$ False

Solution: The median is the grade that divides the upper half of the grades from the lower half. If the average grades is lower than the median, then more than half of the students got a grade greater or equal to the average.

d. [2 points] Let $f(x)$ be a positive and continuous function. If $\lim_{x \to \infty} f(x) = \infty$, then $\int_{0}^{\infty} \frac{1}{f(x)} dx$ converges.

True $\boxed{\text{False}}$

Solution: Consider

$$f(x) = \begin{cases} 1 & \text{for } x \leq 1 \\ x & \text{otherwise.} \end{cases}$$

then $\int_{0}^{\infty} \frac{1}{f(x)} dx = \int_{0}^{1} 1 dx + \int_{1}^{\infty} \frac{1}{x} dx$ diverges since the second integral diverges.

e. [2 points] The line $y = 2x + 1$ has parametric equations $x = -1 + 2t$, $y = -1 + 4t$.

$\boxed{\text{True}}$ False

Solution: $y = -1 + 4t = 2x + 1 = 2(-1 + 2t) + 1 = 4t - 1$