Homework 8 - Math 142 **Name:** ______________________

1. Compute $\lim_{x \to 2} \dfrac{x^2 + 3x - 10}{x - 2}$.

---

2. Compute $\lim_{x \to \pi} \dfrac{x - \pi}{\sin x}$.

---

3. Find $\lim_{x \to 0^+} \left(\dfrac{12}{x} - \dfrac{5}{x^2} \right)$.

---

4. Find $\lim_{x \to \infty} x^{1/x}$. Hint: Let $A = \lim_{x \to \infty} x^{1/x}$ and take the natural log of both sides.

---

5. Which function grows faster as $x \to \infty$, $f(x) = \ln(x^2)$ or $g(x) = \sqrt{x}$? Use L'Hospital's rule to find out.

---

6. Find $\displaystyle\int_0^\infty x^2 e^{-2x}\, dx$.

---

7. Show that each of the following integrals diverge by finding a smaller (simpler) integral that diverges.

   (a) $\displaystyle\int_0^1 \frac{e^x}{x^2}\, dx$

   (b) $\displaystyle\int_e^\infty \sqrt{\ln x}\, dx$

---

8. For each of the following, find a larger integral that converges.

   (a) $\displaystyle\int_0^\infty e^{-x}\sin^2 x\, dx$

   (b) $\displaystyle\int_1^\infty \frac{\sqrt{x}}{1+x^2}\, dx$

---

9. Determine whether the integral $\displaystyle\int_2^\infty \sqrt{\frac{\sqrt{x}+3}{x-1}}\, dx$ converges or diverges by finding a simpler integral to compare it with. Clearly explain how your comparison works.
