

- Please see the course webpage for the answer key.

Compute each of the following Limits. Justify.

$$1. \lim_{x \rightarrow 0} \frac{\cos(4x) - 1 - \arctan(4x) + 4x}{\ln(1-x) + \arcsin x}$$

$$2. \lim_{x \rightarrow 0} \frac{1 - e^{-3x} - \arctan(3x)}{x^2}$$

$$3. \lim_{x \rightarrow \infty} \left(1 - \frac{2}{x^3}\right)^{7x^3}$$

$$4. \lim_{x \rightarrow \infty} \left(\arcsin\left(\frac{1}{x}\right) + e^{\frac{1}{x}}\right)^x$$

$$5. \lim_{x \rightarrow \infty} \left(1 - \arctan\left(\frac{3}{x^4}\right)\right)^{x^4}$$

$$6. \lim_{x \rightarrow 0^+} x^3 \ln x$$

Compute each of the following Integrals. Justify.

$$7. \int \ln x \, dx$$

$$8. \int \arctan x \, dx$$

$$9. \int \arcsin x \, dx$$

$$10. \int \ln(x^2 + 9) \, dx$$

$$11. \text{ Show that } \int_0^{\sqrt{3}} x \arctan x \, dx = \boxed{\frac{2\pi}{3} - \frac{\sqrt{3}}{2}}$$

$$12. \text{ Show that } \int_1^{e^4} \frac{\ln x}{\sqrt{x}} \, dx = \boxed{4e^2 + 4}$$