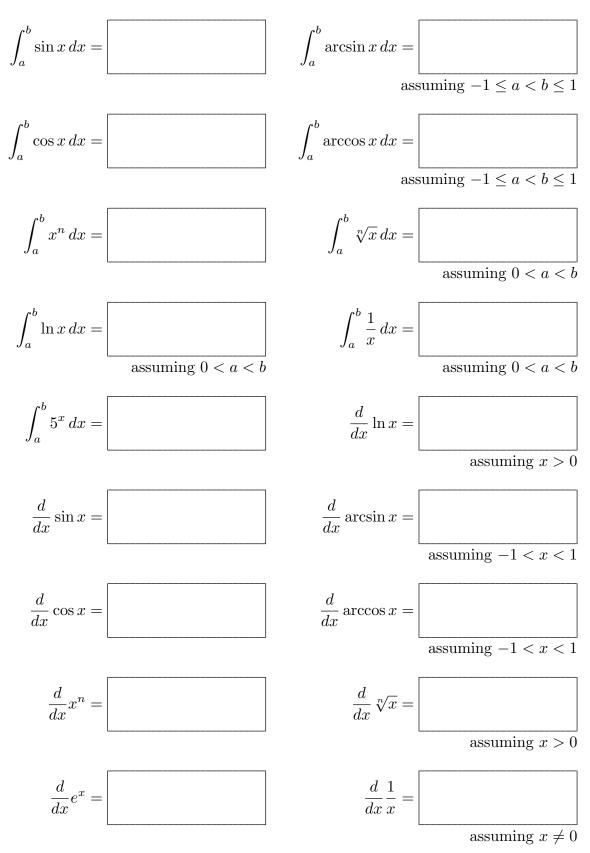
1. State the following integration and differentiation formula:



2. State in terms of ϵ and δ what it means for $\lim_{x \to x_0} f(x) = L$.

3. State the mean value theorem for integrals.

4. Given a function f(x) state the definition of the derivative f'(x) in terms of limits.

5. Use δ and ϵ to show that $f(x) = x^2$ is continuous at $x_0 = 2$.

6. Find a formula for each of the following sums:

(i)
$$\sum_{k=1}^{n} \left(1 + \frac{k}{n} \right)$$

(ii)
$$\sum_{k=1}^{n} (k^2 + 2^k)$$

- **7.** Work one of the following:
 - (i) Let $w \neq x$. Use induction to prove

$$\frac{w^n - x^n}{w - x} = \sum_{k=1}^n w^{n-k} x^{k-1} \quad \text{for} \quad n = 1, 2, 3, \dots$$
(ii) Let $f(x) = \frac{1}{x}$. Use the limit definition of derivative to show $f'(x) = -\frac{1}{x^2}$

8. Find the following limits:

(i)
$$\lim_{x \to 1} \frac{x^2 - 1}{x - 1}$$

(ii)
$$\lim_{x \to 0} \frac{\sin 3x}{4\cos 2x}$$

(iii)
$$\lim_{n \to \infty} \frac{1 - \sqrt[n]{3}}{1 - \sqrt[n]{4}}$$

(iv)
$$\lim_{n\to\infty} \left(3+\frac{1}{n}\right)^n$$

9. Find the following integrals:

(i)
$$\int_0^2 |(x-1)(x+2)| dx$$

(ii)
$$\int_{2}^{5} 7\sqrt{x-1} \, dx$$

(iii)
$$\int_0^{\pi/6} \cos^2(x/2) \, dx$$

(iv)
$$\int_{1}^{4} \ln\left(x^{2} + \frac{3}{2}x - 1\right) dx$$