

Name (30 pts): _____

1. Evaluate $\int_2^8 \frac{d}{dx} \frac{e^{\sin x}}{\sqrt{x}} dx$.

2. Suppose \$10,000 is deposited in a savings account with continuously compounded interest.
- (a) Assuming the account has a doubling time of 15 years, find a formula for the balance after t years.

(b) Determine how quickly the balance is growing after 15 years.

3. For the function $f(x)$ pictured below, list all discontinuities and evaluate $\lim_{x \rightarrow 2} f(x)$.

4. Use the definition of the derivative to find a formula for $\frac{d}{dx} \frac{1}{x}$.

5. Suppose the cost (in dollars) for a farmer to produce q bushels of turnips is given by $C(q) = 30 + 10 \ln q + 0.01q + 10(1.0001)^q$. Find $C'(100)$. Give units and interpret your answer.

6. The number of hours of sunlight in Copenhagen t days after the start of the year is given by $S(t) = 12 + 5 \cos\left(\frac{2\pi}{365}t - \frac{342\pi}{365}\right)$. Determine how quickly the day length is changing 79 days after the start of the year.

7. Evaluate $\frac{d}{dx} \frac{3^x}{e^{3x}}$

For problems 8-10, let $f(x) = 3x^4 + 8x^3 + 6x^2 + 4$.

8. Find the local maxima and minima of $f(x)$.

9. Find the global maxima and minima of $f(x)$ on the interval $(-\infty, 2]$.

10. Find the inflection points of $f(x)$.

11. Evaluate $\int \frac{\sin(\ln(t))}{t} dt$.

12. Suppose the marginal cost (in dollars/bushel) of producing q bushels of parsnips is given by $MC(q) = 0.10 + 0.0001\sqrt{q}$. If the fixed cost of producing parsnips is \$25, determine the total cost of producing 70 bushels using FTC.

13. Estimate the area enclosed by the graph of $f(x) = \sqrt{1 - x^2}$ and the x-axis using a left-hand sum with at least 6 subintervals.

14. A farmer's yearly egg production (in dozens/year) t years after 1930 is given by $P(t) = 75 + 10 \ln(t + 5) + 10 \cos\left(\frac{\pi}{2}t\right)$. Find the average value of $P(t)$ between $t = 5$ and $t = 10$. Give units and interpret your answer.

15. The supply and demand curves for Cashmere (in dollars/skein) are given $S(q) = 1 + q/200$ and $D(q) = 10 - q/200$, where q is the quantity sold in skeins. Find the equilibrium price and quantity and the producer and consumer surplus. Give units with your answer.