



3. Find  $\lim_{x \rightarrow 3} \frac{x^2 - 9}{x - 3}$ .

4. Suppose the crocodile population of a swamp  $t$  weeks after the start of summer is given by  $C(t) = 30 + \sqrt{t} \sin t$ . Find  $C'(6)$ . Give units and interpret your answer.

5. Find an equation to the tangent line of  $f(x) = \ln(x^2)$  at  $x = 1$ .

6. Suppose the *Giardia lamblia* population of a hiker's small intestine  $t$  days after drinking contaminated stream water is given (in millions) by  $G(t) = \frac{1.1^t}{t^2+3}$ . Determine how fast the Giardia population is increasing after 7 days.

7. Find all inflection points of  $f(x) = 2^x - x^2$ .

8. Find all local maxima and minima of  $f(x) = 2^x - 2x$ .

9. Suppose the cost (in dollars) to produce  $q$  Cessnas is given by  $C(q) = \frac{1}{60}q^3 - \frac{105}{4}q^2 + 15,000q + 2,500,000$ , and the revenue generated by selling  $q$  planes is given by  $12,500q$ . Find the maximum profit.

10. Find the area enclosed by the graphs of  $f(x) = x^6$  and  $g(x) = 32x$  using FTC.

11. If the speed of an ICBM (in m/s)  $t$  seconds after launch is given by  $v(t) = 500(1.01)^t + 40\sqrt{t}$ , find  $\int_0^{30} v(t)dt$  using FTC. Give units and interpret your answer.

12. Suppose the distance from a beach house to the shore (in feet)  $t$  hours after 6:00 a.m. is given by  $D(t) = 40 + 20 \cos\left(\frac{2\pi}{12}t\right)$ . Find the average distance to the shore between noon and 8:00 p.m.

13. Find  $\frac{d}{dx} \int_0^x e^t \sin(\ln(t+5)) dt$ .

14. A deflated balloon is attached to a Helium tank. After  $t$  seconds its volume is increasing at a rate of  $B(t) = 20 \ln(t+10)$  cc/sec. Find the volume of the balloon after 30 sec.

15. (Bonus 40 pts). Prove the formula for the area of a triangle with base  $b$  and height  $h$  using FTC. You may assume the triangle has a right angle.

16. (Bonus 30 pts). Find  $\int_3^5 x^2 3^{x^3}$  using FTC.