

Name _____ Score _____

Instructions: This exam is closed-book and closed-notes. Anything may be stored electronically on your calculator. Consultation is allowed ONLY with the instructor. Explain and/or show work for credit.

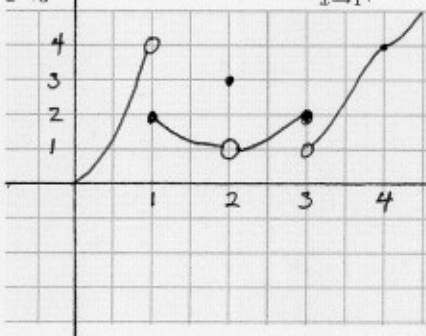
1. For the given graph of f , find each limit, if it exists:

(a) $\lim_{x \rightarrow 3} f(x)$

b. $\lim_{x \rightarrow 1^+} f(x)$

c. $\lim_{x \rightarrow 4} f(x)$

d. $\lim_{x \rightarrow 2} f(x)$

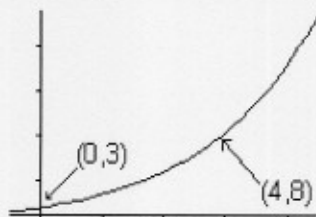


2. Find each limit exactly; if a limit fails to exist, tell what you can about the way in which it does:

(a) $\lim_{x \rightarrow 2} \frac{(x-2)^2}{x^2-4}$

(b) $\lim_{x \rightarrow \infty} \frac{3+x-2x^2}{3x^2-5}$ [Not covered in #5'09]

3. Find the exponential function $f(x) = Ca^x$ whose graph is shown:



[treated only briefly in 5'09]

4. Solve the equation ^{approximately} ~~exactly~~ (don't give a decimal answer) for x : $\ln(x+3) = 5$

[Hint: While we have spent almost no time on the \ln function, it does have a button on our calculator]

5. Use the definition of the derivative to find $f'(a)$ for $f(x) = 2x^2 - 5x + 1$. (Sorry, **no credit** will be given that doesn't involve the definition).

6. Estimate $f'(3)$ if:

(a) $f(x) = (2.3)^x$

(b) f is given by the table:

x	2.7	3.0	3.3	3.6
$f(x)$	69.3	65.4	62.6	61.4

7. Give the equation of the line tangent to $f(x) = \frac{1}{x^2}$ at $a = -2$. (Use any valid method)

8. Find the derivative with respect to x of each expression, and simplify:

(a) $x^4 - 5x^2 + \sqrt{x} - 7$

(b) $e^{5x}(x^2 - 7)$

(c) $\cos(x^2)$

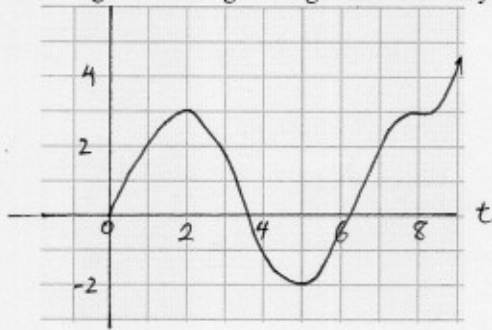
(d) $\sin(e^{3x})$

9. Suppose we know that $f(5) = \pi$ and $f'(5) = \frac{3}{5}$.

(a) If $h(x) = \ln(x) \cdot f(x)$, find $h'(5)$.

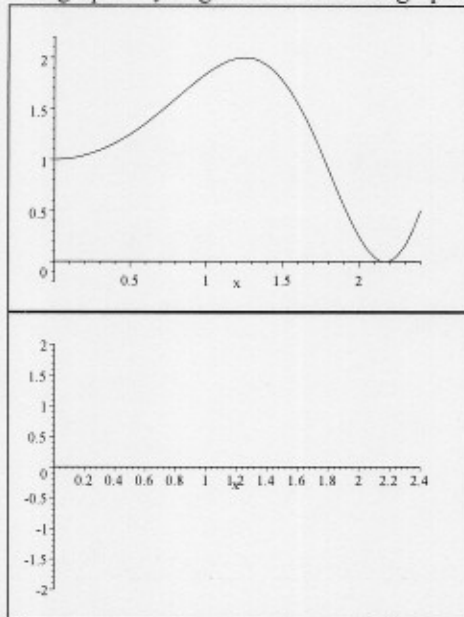
[We covered the derivative of $\ln(x)$ earlier in F'04,
but all you need to know about $\ln(x)$ is that its
derivative is $\frac{1}{x}$]

10. A bug walks along a straight line with varying velocity. The graph of the bug's **position** along the line as a function of time is given



- (a) When is the bug's **velocity** zero? (explain)
- (b) When is the bug's **velocity** increasing? (explain)
11. For the function $f(x) = x^4$: [not covered in S'09]
- (a) Give the linearization for f at $a = 1$ →
- (b) Use your answer in (a) to estimate $f(1.05)$. ↗
12. Suppose that $W(t)$ is the amount of sand (in tons) in a certain pile, t hours after the morning shift begins at a quarry.
- (a) Suppose $W'(3) = -0.38$. What does this mean, in practical terms, for the quarry manager?

13. The graph of f is given. Sketch the graph of $f'(x)$ on the axes provided:



14. For the function $x^2 e^{0.01x}$, find all local maxima and minima (and tell which is which):

15. Find the global minimum of $f(x) = x^4 - 7x^2 + 16$ on $[-1, 2]$.

16. A rectangle is to be cut from a piece of paper; the paper is in the shape of a right triangle with legs of 10 inches and 5 inches. If one corner of the rectangle is to coincide with the right angle of the triangle, how should the rectangle be made to maximize area?

17. Suppose for a function f that $f'(x) = 3 \cos(x)$, and $f(0) = 4$. What is $f(x)$?

18. Estimate the area under the curve e^{-x^2} from $x = 0$ to $x = 2$; describe your method.

19. Find each definite integral exactly:

(a) $\int_1^5 x^6 - 3x^2 + 5 dx$

(b) $\int_0^{\pi/6} \sin(x) dx$ Hint: remember to check your work

Topics we did cover in S'09 not included here:

- Related rates
- Even & odd functions
- Graph transformations, e.g. $f(x) \rightarrow 2f(x+3)$
- Interpreting the graph of f' to tell about the graph of f . (see exam 3, S'09)
- ...to name a few