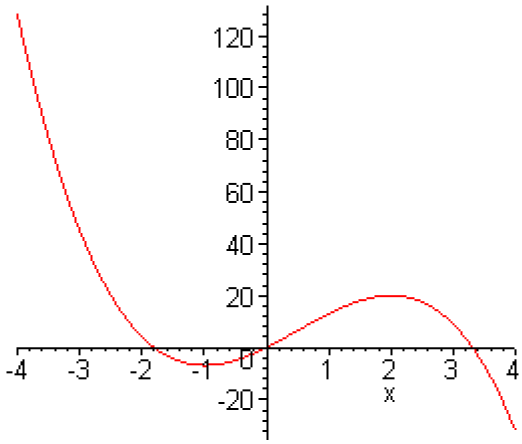
171 test 3 Name________________________________

1. On which intervals is the function $f(x) = -2x^3 + 3x^2 + 12x$ increasing? Where is it decreasing? Here is a picture from maple to help, but you must show your work.



Answer: Increasing over ___________________, decreasing over ____________________

2. Over what interval(s) is the above function concave up (leaning to the left) and concave down?

Answer: concave up over _________________, concave down over ______________.

3. Locate the maximum and minimum values of the function $f(x) = x^2 + \frac{2}{x}$ on the interval $[\frac{1}{2}, 2]$. Don't forget to check the endpoints as well as the critical points.

Answer: Minimum is __________, maximum is _________.

4. Approximate the cube root of 9 by using Newton's method to find the root of $y = x^3 - 9$. Start with the first guess of 2 and fill in the table.

x	y	y'
2	-1	?
?	?	

5. What does the mean value theorem say about the function $f(x) = x^3 - 9$ on the interval [0, 3]?

6. For question above, find the number in the interval (0, 3) guaranteed by the mean value theorem to exist.

Use L'Hôpital's rule if applicable to find the following limits:

7. $\lim_{x \to 0} \frac{\cos(x) - 1}{x}$

8. $\lim_{x\to 0} \frac{x}{e^x}$

9. $\lim_{x\to 4} \frac{\sqrt{x}-2}{x-4}$

10. Definition: If f is continuous on [a , b], the **definite integral of *f* from *a* to *b* is**

$\int_a^b f(x)dx =$

11. Define each symbol on the right hand side of the equal sign above.

12. Suppose $\int_a^b f(x)dx = -5$, $\int_a^c f(x)dx = 2$. What is $\int_c^b f(x)dx$?

13. For the function above, what is $\int_b^a f(x)dx$

14. Let $F(x) = \int_a^x f(t)dt$. F is a function of what variable? ___________

15. For the function defined above, what is $F'(x)$?

16. Evaluate $\int_1^4 \frac{1}{\sqrt{t}} dt$

17. What are $\int_1^4 \frac{1}{\sqrt{x}} dx$ and $\int_1^4 \frac{1}{\sqrt{z}} dz$? Answer: _____________ and ______________

18. Let $F(x) = x\ln x - x$ show that $F'(x) = \ln x$ (Don't forget the product rule!)

19. Evaluate $\int_1^e \ln x dx$