DEC. 8, 2017 **Math 125 - Some practice questions**

NOT COMPREHENSIVE!

Note: This review contains questions covered in **chapters 5-8** of the Math 125 textbook (with one exception). This set of practice questions is not comprehensive. The problems on this test were not selected by your professor, and are based on textbook problems and other resources. ****Your study plan should include going over your lecture notes, the Math 125 lecture notes, textbook, homework problems, including chapter review problems, and online resources. You should not rely solely on this mock test for your test preparation.****

Please email Holly at holly.fraser@usask.ca if you have questions. Answers will be posted at: http://library.usask.ca/math-help

1. Consider the function $f(x) = 4x^3 - x^4$.
   a) What is the domain?
   b) What is/are the x-intercept(s)?
   c) What is the y-intercept?
   d) Find the intervals where f is increasing, and the intervals where f is decreasing.
   e) Find any relative maximum or minimum values of f.
   f) Find the intervals where f is concave up and where f is concave down.
   g) Find any inflection points.
   h) Sketch the graph.

2. Find any inflection points of the graph of $f(x) = \frac{\ln x}{x^2}$.

3. Consider the equation $y \ln x + xe^y = 1$.
   a) Find y if $x = 1$.
   b) If $x = 1$ and $\frac{dx}{dt} = 5$, and using your value for y from part a), find $\frac{dy}{dt}$.

4. A large weather balloon is being inflated with air at a rate of 0.9 cubic feet per minute. How fast is the radius of the balloon increasing when the radius is 1.7 feet? (Hint: the volume of a sphere is $V = \frac{4}{3}\pi r^3$.
5. Use the differential (or linear approximation) to approximate $\sqrt{0.65}$.

6. The concentration (in g/mL) of a certain drug in the bloodstream t hours after being administered is approximately $C(t) = 7e^{-0.12t}$. Use the differential (or linear approximation) to estimate the change in concentration from 1 hour after administration to 1.5 hours after administration.
7. Find the absolute maximum and absolute minimum of the function $f(x) = x + 3x^{\frac{2}{3}}$ on the interval $[-20,1]$.

8. The work done by a crow to break open a small marine snail can be estimate by the function
$$W = \left(1 + \frac{20}{h - 0.93}\right)h,$$
where h is the height (in metres) of the snail when it is dropped.
   a) Find $\frac{dW}{dh}$.
   b) At what height is the amount of work minimized?

These questions have been adapted from *Calculus for the Life Sciences* (Greenwell, Ritchey, and Lial), *Single Variable Calculus – Early Transcendentals* (Stewart) and mock term tests from other courses.

9. The packaging department of a corporation is designing a box with a square base and no top. The volume is to be 32 m^3. To reduce cost, the box is to have minimum surface area. What dimensions should the box have?

10. Find the asymptotes of the graph of the function $f(x) = \frac{x^2}{9-x^2}$.

11. Find the equation of the tangent line to the graph of $2x + \cos(x + y) = xy^2$ at the point where $(-1,1)$.

12. The approximate rate of change in the number (in billions) of monthly text messages is given by $f'(t) = 7.50t - 16.8$, where t represents the number of years since 2000. In 2005 ($t = 5$) there were approximately 9.8 billion text messages.
    a) Find $f(t)$.
    b) According to this function, how many monthly text messages were there in 2009?
    c) According to this function, by what year will 200 billion monthly text messages be sent?

13. Find the area bounded between the graphs of $y = 4x$ and $y = x^3$.

14. An epidemic is growing in a region according to the rate $N'(t) = \frac{100t}{t^2+2}$, where $N(t)$ is the number of people infected after t days. Find a formula for the number of people infected after t days, given that 37 people were infected at $t = 0$.

15. The rate at which a substance grows is given by $R'(t) = 150e^{0.2t}$, where t is the time (in days). What is the total accumulated growth during the first 3.5 days?

16. Evaluate each integral.
    a) $\int \left(\frac{w^5}{2} - \frac{2}{w^5} + e\right) dw$
    b) $\int \frac{e^x}{(5+e^x)^2} dx$
    c) $\int (1 - x)e^{2x-x^2} dx$
    d) $\int \frac{1-\sqrt{x}}{\sqrt{x^3}} dx$
    e) $\int \sec^2 x \sqrt{\tan x + 1}\, dx$
    f) $\int_1^e \ln x \, dx$

17. Find the area below the graph of $y = \sin\left(\frac{1}{2}x\right)$ and above the x-axis from $x = 0$ to $x = \pi$.

18. Tree scientists have observed that a eucalyptus tree will grow at the rate $0.6 + \frac{4}{(t+1)^3}$ feet per year, where t is time (in years). Find the number of feet that the tree will grow in the second year.

19. Find the volume of the solid of revolution formed by rotating the region bounded by the graph of $y = e^{0.5x}$, $y = 0$, $x = -2$ and $x = -1$, about the x-axis.

20. Find the average value of $f(x) = 2 - 10\cos x$ over the interval $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$.

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