Spring 2012 Math 151

Sample Problems for Exam 1

sections: Chapter 1, 2,2, 2,3, 2.5, 2.6, 2.7, and 3.1

courtesy: Joe Kahlig

1. Use $\lim_{h\to 0} \dfrac{f(x+h)-f(x)}{h}$ to compute the derivative.

   (a) $f'(x) = \dfrac{6}{(x+3)^2}$

   (b) $f'(x) = \dfrac{1}{\sqrt{2x+1}}$

2. $f'(x) = 3x^2 - 2x + 7$ and $f'(2) = 15$

3. $f'(x) = \dfrac{1}{\sqrt{2x+1}}$, so $m_{tan} = f'(4) = \dfrac{1}{3}$

   $y - 3 = \dfrac{1}{3}(x-4)$

4. $\lim_{x\to 3} \dfrac{f(x)-5}{x-3} = f'(3) = 5$

5. (a) $\lim_{x\to -2} f(x) = 3$

   (b) $\lim_{x\to 4} f(x)$ =DNE

   (c) not continuous at $x = -2$ and $x = 2$ (from either side).
   not conitinuous at $x = 4$ (is continuous from the right)

   (d) not differentiable at $x = -5$, $x = -2$, $x = 2$, $x = 4$, and $x = 6$

6. Answers will vary.

   $y = \dfrac{7x(x-5)}{(x-5)(x+3)}$ or $y = \dfrac{7x(x-5)(x+3)}{(x-5)(x+3)^2}$

7. $\frac{6}{250}$

8. ∞

9. DNE

10. $\dfrac{4}{7}$

11. $\dfrac{2}{5}$

12. (a) $\dfrac{6}{5}$

    (b) $-\infty$

13. not continuous at $x = -3$ since $f(-3)$ DNE
    not continuous at $x = 1$ since $\lim_{x\to 1} f(x)$ DNE.

14. $A = \dfrac{5}{2}$ and $B = 19$

15. (a) scalar projection: $\text{comp}_{\mathbf{n}}\ \mathbf{m} = \dfrac{15}{\sqrt{10}}$

vector projection: $\text{proj}_{\mathbf{n}}\ \mathbf{m} = \left\langle \dfrac{15}{10}, \dfrac{-45}{10} \right\rangle$

(b) $\theta = \arccos\left(\dfrac{3}{\sqrt{10}}\right) = 18.43^o$

16. answers can vary.

$x(t) = 2 + 5t$, $y(t) = 4 + t$

17. direction vectors are $\mathbf{v_1} =< -6, 9 >$ and $\mathbf{v_2} =< -3, -2 >$

lines are orthogonal if $\mathbf{v_1} \cdot \mathbf{v_2} = 0$

$\mathbf{v_1} \cdot \mathbf{v_2} = -6 * -3 + 9 * -2 = 18 - 18 = 0$

18. 21Nm = 21 J

19. speed = 21.755mph

direction is S62.63^{o}E

20. (a) $y = (x-1)^2$ with $0 \leq x \leq 2$

(b) yes, when $t = \dfrac{\pi}{2} + n\pi$ when n is an integer.

(c) see the graph in the written solutions.

21. $\dfrac{-7\sqrt{51}}{50}$

22. 49.97^o