MATH 151, FALL 2013
COMMON EXAM I - VERSION A

LAST NAME: _____ FIRST NAME: _____

INSTRUCTOR: _____

SECTION NUMBER: _____

UIN: _____

DIRECTIONS:

1. The use of a calculator, laptop or computer is prohibited.
2. TURN OFF cell phones and put them away. If a cell phone is seen during the exam, your exam will be collected and you will receive a zero.
3. In Part 1 (Problems 1-15), mark the correct choice on your ScanTron using a No. 2 pencil. The ScanTron will not be returned, therefore *for your own records, also record your choices on your exam!* Each problem is worth 3 points.
4. In Part 2 (Problems 16-22), present your solutions in the space provided. *Show all your work* neatly and concisely and *clearly indicate your final answer*. You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.
5. Be sure to *write your name, section number and version letter of the exam on the ScanTron form.*

THE AGGIE CODE OF HONOR

"An Aggie does not lie, cheat or steal, or tolerate those who do."

Signature: _____

DO NOT WRITE BELOW!

Question	Points Awarded	Points
1-15		45
16		6
17		8
18		5
19		10
20		10
21		8
22		8
		100

PART I: Multiple Choice. 3 points each

1. If $\mathbf{a} = \langle 1, 1\rangle$, $\mathbf{b} = \langle 2, 1\rangle$ and $\mathbf{c} = \langle 4, -3\rangle$, what value of t satisfies $\mathbf{c} = s\mathbf{a} + t\mathbf{b}$, where s and t are scalars?

   (a) $t = -7$

   (b) $t = 7$

   (c) $t = -10$

   (d) $t = 1$

   (e) $t = 2$

2. Find $\lim\limits_{x \to 3^-} \dfrac{|x-3|}{x^2 - 2x - 3}$

   (a) $-\dfrac{1}{4}$

   (b) 0

   (c) ∞

   (d) $\dfrac{1}{4}$

   (e) The limit does not exist

3. Find the vector projection of $\langle -3, 1\rangle$ onto $\langle 2, 5\rangle$.

   (a) $\left\langle -\dfrac{2}{\sqrt{29}}, -\dfrac{5}{\sqrt{29}} \right\rangle$

   (b) $\left\langle \dfrac{3}{10}, -\dfrac{1}{10} \right\rangle$

   (c) $\left\langle \dfrac{3}{\sqrt{10}}, -\dfrac{1}{\sqrt{10}} \right\rangle$

   (d) $\left\langle -\dfrac{2}{29}, -\dfrac{5}{29} \right\rangle$

   (e) $\left\langle \dfrac{11}{29}, \dfrac{55}{29} \right\rangle$

4. Find $\lim\limits_{x \to -1^-} \dfrac{x-2}{x+1}$

   (a) ∞

   (b) 0

   (c) 1

   (d) $-\infty$

   (e) The limit does not exist

5. Given the points $A(0,1)$, $B(2,0)$ and $C(3,-4)$, find the angle, α, located at the vertex A. That is, $\angle BAC$.

(a) $\alpha = \arccos\left(\dfrac{11}{\sqrt{170}}\right)$

(b) $\alpha = \arccos\left(-\dfrac{11}{\sqrt{170}}\right)$

(c) $\alpha = \arccos\left(\dfrac{1}{\sqrt{170}}\right)$

(d) $\alpha = \arccos\left(\dfrac{-6}{\sqrt{85}}\right)$

(e) $\alpha = \arccos\left(\dfrac{2}{\sqrt{85}}\right)$

6. Find $\lim\limits_{t\to 4} \mathbf{r}(\mathbf{t})$ where $\mathbf{r}(\mathbf{t}) = \left\langle 2t+1, \dfrac{\sqrt{t+5}-3}{t-4} \right\rangle$.

(a) $\langle 9, 0\rangle$

(b) $\langle 9, 1\rangle$

(c) $\left\langle 9, \dfrac{1}{6} \right\rangle$

(d) $\left\langle 9, -\dfrac{1}{6} \right\rangle$

(e) $\left\langle 9, -\dfrac{1}{2} \right\rangle$

7. Find the horizontal and vertical asymptotes for $f(x) = \dfrac{(2-x)(3x+1)}{x^2-4}$.

(a) $x = -3$, $y = -2$

(b) $y = -3$, $x = 2$, $x = -2$

(c) $x = -3$, $y = 2$, $y = -2$

(d) $y = -3$, $x = -2$

(e) $y = 3$, $x = -2$

8. Find a unit vector in the direction of $\mathbf{a} - \mathbf{b}$ where $\mathbf{a} = \mathbf{i} - 3\mathbf{j}$ and $\mathbf{b} = -5\mathbf{j}$.

(a) $\dfrac{6}{\sqrt{45}}\mathbf{i} - \dfrac{3}{\sqrt{45}}\mathbf{j}$

(b) $\dfrac{1}{\sqrt{5}}\mathbf{i} + \dfrac{2}{\sqrt{5}}\mathbf{j}$

(c) $\dfrac{1}{\sqrt{65}}\mathbf{i} - \dfrac{2}{\sqrt{65}}\mathbf{j}$

(d) $\dfrac{2}{\sqrt{5}}\mathbf{i} - \dfrac{1}{\sqrt{5}}\mathbf{j}$

(e) $\dfrac{8}{\sqrt{65}}\mathbf{i} - \dfrac{1}{\sqrt{65}}\mathbf{j}$

9. Which interval contains a solution to the equation $x^3 + x = 3$?

   (a) $[-1, 0]$
   (b) $[0, 2]$
   (c) $[0, 1]$
   (d) $[-2, -1]$
   (e) $[2, 4]$

10. Consider $f(x) = \begin{cases} x^2 + 5x + 1 & \text{if } x < -1 \\ 3 & \text{if } x = -1 \\ 2x - 1 & \text{if } x > -1 \end{cases}$. Why is $f(x)$ not continuous at $x = -1$?

    (a) $f(x)$ is not continuous at $x = -1$ because $\lim_{x \to -1} f(x) \neq f(-1)$.
    (b) $f(x)$ is not continuous at $x = -1$ because $f(-1)$ does not exist.
    (c) $f(x)$ is not continuous at $x = -1$ because $\lim_{x \to -1} f(x)$ does not exist.
    (d) $f(x)$ is not continuous at $x = -1$ because $\lim_{x \to -1^-} f(x)$ does not exist.
    (e) $f(x)$ is not continuous at $x = -1$ because $\lim_{x \to -1^+} f(x)$ does not exist.

11. A horizontal force of 20 pounds is acting on a box as it is pushed up a ramp that is 5 feet long and inclined at an angle of 60° above the horizontal. Find the work done on the box.

    (a) $50\sqrt{3}$ foot pounds
    (b) $50\sqrt{2}$ foot pounds
    (c) 100 foot pounds
    (d) 10 foot pounds
    (e) 50 foot pounds

12. Find $\lim_{x \to 2} \dfrac{x^4 - 16}{x - 2}$.

    (a) 0
    (b) ∞
    (c) 4
    (d) 32
    (e) 1

13. Find the value of x so that the vectors $\langle 4, x+1 \rangle$ and $\langle x, 3 \rangle$ are perpendicular.

(a) $x = 0$

(b) $x = -\dfrac{7}{3}$

(c) $x = -\dfrac{3}{7}$

(d) $x = -\dfrac{1}{7}$

(e) $x = \dfrac{1}{7}$

14. Find the average rate of change of $f(t) = \sqrt{2t+3}$ from $t = 1$ to $t = 3$.

(a) $3 - \sqrt{5}$

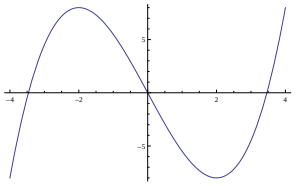
(b) $\dfrac{3+\sqrt{5}}{2}$

(c) $\dfrac{\sqrt{5}-3}{2}$

(d) $3 + \sqrt{5}$

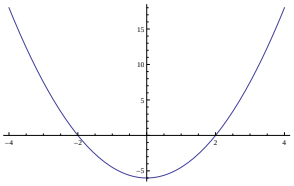
(e) $\dfrac{3-\sqrt{5}}{2}$

15. Consider The graph of $f(x)$ given:

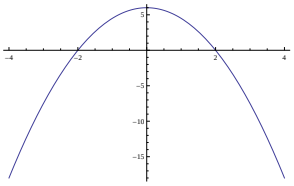


Which of the following is the graph of its derivative, $f'(x)$?

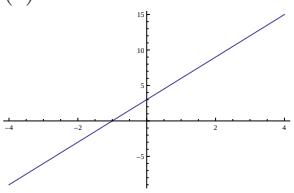
(a)



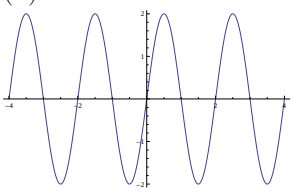
(b)



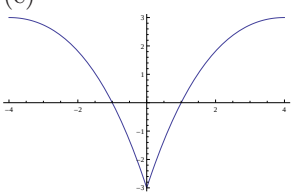
(c)



(d)



(e)



PART II: Work Out

Directions: Present your solutions in the space provided. *Show all your work* neatly and concisely and *Box your final answer*. You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.

16. Consider the line $x = 8 - 2t$, $y = 14 + 7t$.

(i) (2 pts) Find a vector parallel to the line.

(ii) (2 pts) Find a vector perpendicular to the line.

(iii) (2 pts) Find the x and y intercepts of the line.

17. (8 pts) Find $\lim_{x\to\infty} \left(\sqrt{x^2 + 6x - 1} - x\right)$.

18. (5 pts) If $f(2) = 3$ and $f'(2) = -7$, find the equation of the tangent line to the graph of $f(x)$ at $x = 2$.

19. (10 pts) For $f(x) = \dfrac{1}{2x+1}$, find $f'(x)$ using the limit definition of the derivative.

20. (10 pts) Consider $f(x) = \begin{cases} cx+2 & \text{if } x > 5 \\ \frac{1}{2} & \text{if } x = 5 \\ cx^2 - 4 & \text{if } x < 5 \end{cases}$

(i) Find $\lim_{x \to 5^+} f(x)$ in terms of c.

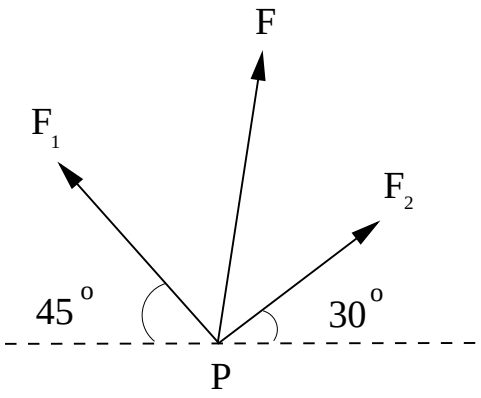
(ii) Find $\lim_{x \to 5^-} f(x)$ in terms of c.

(iii) For what value of c does $\lim_{x \to 5} f(x)$ exist?

(iv) For the value of c found above, what is $\lim_{x \to 5} f(x)$?

(v) For the value of c above, is $f(x)$ continuous at $x = 5$? Support your answer.

21. (8 pts) Two forces $\mathbf{F_1}$ and $\mathbf{F_2}$ with magnitudes 6 lbs and 4 lbs, respectively, act on an object at a point P as shown.



(i) Find the vector, $\mathbf{F_1}$. Evaluate trig functions.

(ii) Find the vector, $\mathbf{F_2}$. Evaluate trig functions.

(iii) Find the resultant force, $\mathbf{F}$, acting on the object.

22. Consider the curve $x = 3 + \cos t$, $y = -1 + \sin t$.

(i) (4 pts) Eliminate the parameter to find a Cartesian equation.

(ii) (4 pts) Sketch the curve on the grid below.