MATH 151, **FALL SEMESTER 2011**

COMMON EXAMINATION I - **VERSION A**

Name (print): _____ Instructor's name: _____

Signature: _____ Section No: _____

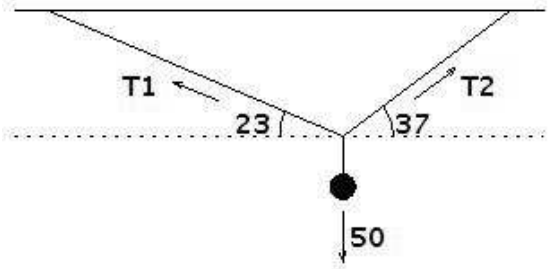
Part 1 – **Multiple Choice** (**12 questions**, **4 points each**, **No Calculators**)

Write your name, section number, and version letter (**A**) of the exam on the ScanTron form.
Mark your responses on the ScanTron form and on the exam itself

1. Let $\mathbf{v} = \langle 2, 4 \rangle$ and $\mathbf{w} = -2\mathbf{i} + 6\mathbf{j}$. Compute $\left| \frac{1}{2}\mathbf{v} - \mathbf{w} \right|$.

a. 1
b. 2
c. 3
d. 4
e. 5

2. A ball whose weight is 50 Newtons hangs from two wires, one at angle $23°$ from horizontal, and the other at angle $37°$ from horizontal. Let $\mathbf{T}_1$ be the tension in the first wire, and $\mathbf{T}_2$ be the tension in the second wire. Which set of equations can be used to solve for $\mathbf{T}_1$ and $\mathbf{T}_2$?



a. $-|\mathbf{T}_1|\cos 23° + |\mathbf{T}_2|\cos 37° = 0$ and $|\mathbf{T}_1|\sin 23° + |\mathbf{T}_2|\sin 37° = 50$
b. $-|\mathbf{T}_1|\cos 23° + |\mathbf{T}_2|\cos 37° = 50$ and $-|\mathbf{T}_1|\sin 23° + |\mathbf{T}_2|\sin 37° = 0$
c. $|\mathbf{T}_1|\cos 23° + |\mathbf{T}_2|\cos 37° = 50$ and $-|\mathbf{T}_1|\sin 23° + |\mathbf{T}_2|\sin 37° = 0$
d. $-|\mathbf{T}_1|\cos 23° + |\mathbf{T}_1|\cos 37° = 0$ and $|\mathbf{T}_2|\sin 23° + |\mathbf{T}_2|\sin 37° = 50$
e. $|\mathbf{T}_1|\cos 23° + |\mathbf{T}_2|\cos 37° = 0$ and $-|\mathbf{T}_1|\sin 23° + |\mathbf{T}_2|\sin 37° = 50$

3. Find the angle between the vectors $\mathbf{v} = \langle 1, 2 \rangle$ and $\mathbf{w} = \langle 3, 1 \rangle$.

a. $0°$
b. $30°$
c. $45°$
d. $60°$
e. $90°$

4. Find the scalar projection (component) and vector projection of $\mathbf{v} = 5\mathbf{i} - 12\mathbf{j}$ onto $\mathbf{w} = 4\mathbf{i} + 3\mathbf{j}$.

a. scalar projection $= \frac{16}{13}$ vector projection $= \frac{64}{169}\mathbf{i} + \frac{48}{169}\mathbf{j}$

b. scalar projection $= -\frac{16}{13}$ vector projection $= -\frac{64}{169}\mathbf{i} - \frac{48}{169}\mathbf{j}$

c. scalar projection $= -\frac{16}{5}$ vector projection $= \frac{64}{25}\mathbf{i} - \frac{48}{25}\mathbf{j}$

d. scalar projection $= \frac{16}{5}$ vector projection $= \frac{64}{25}\mathbf{i} + \frac{48}{25}\mathbf{j}$

e. scalar projection $= -\frac{16}{5}$ vector projection $= -\frac{64}{25}\mathbf{i} - \frac{48}{25}\mathbf{j}$

5. Find the Cartesian equation for the graph of the parametric curve $x = -1 + t$ and $y = t^2 - t$.

a. $y = x^2 - x$

b. $y = x^2 + x$

c. $y = x^2 + 3x$

d. $y = x^2 + 3x + 2$

e. $y = x^2 - 3x + 2$

6. Find a vector equation for the line which contains the point $(2, -1)$ and is parallel to $\langle 3, 4 \rangle$.

a. $\mathbf{r}(t) = \langle 1 + 4t, -2 + 3t \rangle$

b. $\mathbf{r}(t) = \langle -3 - t, -4 + 2t \rangle$

c. $\mathbf{r}(t) = \langle 3 + 2t, 4 - t \rangle$

d. $\mathbf{r}(t) = \langle 2 + 3t, -1 + 4t \rangle$

e. $\mathbf{r}(t) = \langle -2 - 3t, 1 - 4t \rangle$

7. Let $f(x) = \frac{x^2 - 4}{(x-2)^2}$. Which of the following is true?

a. $\lim_{x \to 2^-} f(x) = +\infty$ and $\lim_{x \to 2^+} f(x) = +\infty$

b. $\lim_{x \to 2^-} f(x) = +\infty$ and $\lim_{x \to 2^+} f(x) = -\infty$

c. $\lim_{x \to 2^-} f(x) = -\infty$ and $\lim_{x \to 2^+} f(x) = +\infty$

d. $\lim_{x \to 2^-} f(x) = -\infty$ and $\lim_{x \to 2^+} f(x) = -\infty$

e. None of these.

8. Compute $\lim_{t\to 1} \frac{1-t^2}{1-\sqrt{t}}$

a. 1
b. 2
c. 3
d. 4
e. Does not exist

9. Which interval contains the unique real solution of the equation $2x^3 + x^2 + 2 = 0$?

a. $(-2,-1)$
b. $(-1,0)$
c. $(0,1)$
d. $(1,2)$
e. $(2,3)$

10. Which of the following is a horizontal asymptote of $f(x) = \frac{3x^2+2}{(x-2)(x+2)}$?

a. $y = \frac{1}{3}$
b. $y = 3$
c. $y = -2$
d. $y = -\frac{1}{2}$
e. None of the above

11. Evaluate $\lim_{x\to 3^+} \frac{2x^2-3x}{x(x+3)}$

a. $-\infty$
b. 0
c. $\frac{1}{2}$
d. 1
e. ∞

12. Evaluate $\lim_{x\to -\infty} \frac{2x^2+3x}{x-3}$

a. $-\infty$
b. -1
c. $-\frac{2}{3}$
d. 2
e. ∞

Part 2 – **Work Out Problems** (**5 questions**. **Points indicated**. **No Calculators**)

Solve each problem in the space provided. Show all your work neatly and concisely, and indicate your final answer clearly. You will be graded, not merely on the final answer, but also on the quality and correctness of the work leading up to it.

13. (10 points) An object is moving in the xy-plane and its position vector after t seconds is $\mathbf{r}(t) = \langle t - 3, t^2 - 2t \rangle$.

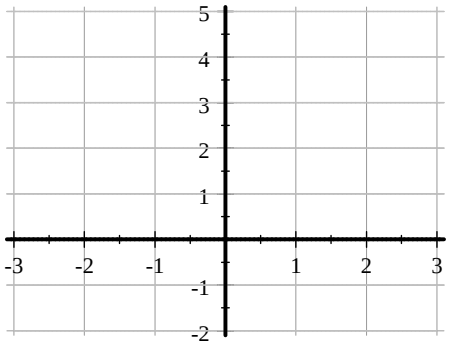
a. Find the position vector of the object at time $t = 5$.

b. Does the object pass through the point $(1, 8)$? If yes, when? If no, why not?

c. Does the object pass through the point $(2, 20)$? If yes, when? If no, why not?

14. (14 points) Sketch the graph of the function

$$g(x) = \begin{cases} -x - 1 & \text{if} \quad x < -2 \\ 3 & \text{if} \quad x = -2 \\ |x| & \text{if} \quad -2 < x < 1 \\ x^2 - 2 & \text{if} \quad x \geq 1 \end{cases}$$



Then determine each of the following

$\lim_{x \to -2^-} g(x) =$ _____ $\lim_{x \to -2^+} g(x) =$ _____ $g(-2) =$ _____

$\lim_{x \to 1^-} g(x) =$ _____ $\lim_{x \to 1^+} g(x) =$ _____ $g(1) =$ _____

List all value(s) of x where $g(x)$ is NOT differentiable: _____

15. (9 points) Compute each of the following or prove the limit does not exist.

a. $\lim_{x\to 2^+} \dfrac{|x-2|}{x^2-2x} =$

b. $\lim_{x\to 2^-} \dfrac{|x-2|}{x^2-2x} =$

c. $\lim_{x\to 2} \dfrac{|x-2|}{x^2-2x} =$

16. (9 points) Consider $f(x) = \begin{cases} \dfrac{x^2-2x-8}{x-4} & \text{if } x \neq 4 \\ p & \text{if } x = 4 \end{cases}$

a. Find $\lim_{x\to 4} f(x)$ or explain why it does not exist.

b. Find the value(s) of p that make $f(x)$ continuous at $x = 4$ or explain why no such p exists.

17. (10 points) Consider the function $f(x) = \dfrac{1}{x}$.

a. Find $f'(x)$, the derivative of $f(x)$, using the limit definition of the derivative.

b. Find the slope of the tangent line to the curve $y = f(x)$ at $x = 3$.

Name (print): _____ Section No: _____

Question	Points/Max
1-12	/48
13	/10
14	/14
15	/ 9
16	/ 9
17	/10
Total	/100