



**Math 151**  
**Week-In-Review 4**

**Exam 1 Review**  
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**Problem Statements**

1. Let  $\mathbf{a} = \langle -3, 7 \rangle$ ,  $\mathbf{b} = 4\mathbf{i} - \mathbf{j}$ , and  $\mathbf{c} = 2\mathbf{a} - 3\mathbf{b}$ , find the following.

(a)  $\mathbf{c}$

(b)  $|\mathbf{c}|$

(c) The angle  $c$  makes with the positive  $x$ -axis.

(d)  $\text{comp}_{\mathbf{a}}\mathbf{b}$

(e)  $\text{proj}_{\mathbf{a}}\mathbf{b}$

(f) The angle between vectors  $\mathbf{a}$  and  $\mathbf{b}$



2. Determine the value(s) of  $x$  for which the vectors  $\langle x, -2 \rangle$  and  $\langle x - 9, 5 \rangle$  are perpendicular.

3. Determine the work done by a Force  $\mathbf{F} = \langle 12, 7 \rangle$  as it moves an object from the point  $(-1, 2)$  to the point  $(8, 6)$ .



4. A cruise ship is headed N  $45^\circ$  W at 30 mph. Daredevil Darren is driving a motorcycle on deck due East at 60 mph. Just as Darren is about to jump off of the ship, a wind blows in, pushing 20 mph at N  $30^\circ$  E. What is Darren's speed as he jumps off the ship? Find the direction he is headed as he leaves the ship, as a bearing.



5. Find a Cartesian Equation of the curve  $x = 4t^2 - 3$  and  $y = 2t + 1$ . Sketch the curve and indicate the direction of motion as  $t$  increases.

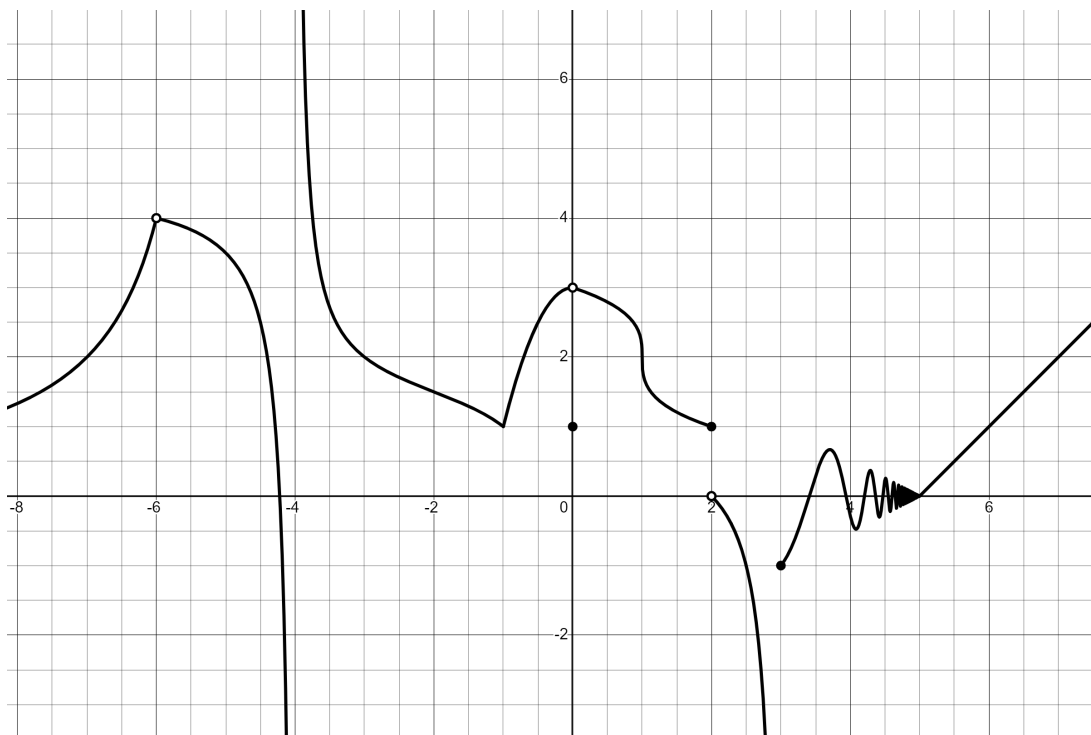
6. Find a vector equation of the line parallel to  $y = -6x + 7$  that passes through the point  $(-24, 601)$ .



7. Examine the following graph.

(a) Determine the locations of all discontinuities on the following graph. Explain why the function is discontinuous at each.

(b) Determine the locations of each location where the function below is not differentiable. Explain why the derivative does not exist at each.





8. Evaluate the following limits.

(a)  $\lim_{x \rightarrow 2} \frac{4x - 8}{x^2 - 4x - 4}$

(b)  $\lim_{t \rightarrow 0} \left( \frac{5}{t} - \frac{5}{t^2 + t} \right)$



9. Determine the values of  $a$  and  $b$  that make  $f(x)$  continuous everywhere.

$$f(x) = \begin{cases} \frac{x^2 - 9}{x + 3} & \text{if } x < -3 \\ ax^2 + bx - 3 & \text{if } -3 \leq x < 2 \\ 6x - b & \text{if } x \leq 2 \end{cases}$$



10. Consider the function  $f(x) = \frac{4x^2 + 4x - 8}{x^2 - x - 6}$ .

(a) For what values of  $x$  is  $f(x)$  undefined?

(b) Determine the location ( $x$ -value) of any holes in the function. For each hole, what could we define  $f(a)$  to be so that the function is continuous at  $a$ ?

(c) Determine any vertical asymptotes of the function. What is  $\lim_{x \rightarrow a^-} f(x)$  and  $\lim_{x \rightarrow a^+} f(x)$  for each?

(d) Determine any horizontal asymptotes of the function.





11. Determine the horizontal asymptotes for each of the following. If there is not a horizontal asymptote, determine  $\lim_{x \rightarrow -\infty} f(x)$  and  $\lim_{x \rightarrow \infty} f(x)$ .

(a)  $f(x) = \frac{888x^4 - 555x^5}{2x^2 + x^6}$

(b)  $f(x) = \frac{-2e^{6x} + 7e^{-2x}}{11e^{6x} - e^{-3x}}$



(c)  $f(x) = \frac{3x - 5x^7}{2x^4 - 5}$

(d)  $f(x) = \frac{\sqrt{4x^2 - 16} - 3x}{7x - 2}$



12. The position of an object on the  $x$ -axis is  $x(t) = \frac{5}{t+1}$ , where  $t \geq 0$ .

(a) Determine the average velocity of the object on the interval from  $t = 0$  to  $t = 4$ .

(b) Determine the instantaneous velocity of the object when  $t = 4$ .



13. Determine the derivative of  $f(x) = \sqrt{3x^2 - 2x + 5}$ .



14. Which theorem from this course would help determine a solution to the following questions?  
If there is time, we will also solve these problems.

(a) Determine which of the following intervals contain at least one solution to the equation  $12x - e^x = 5x^2 - 17$ . Select all that apply.

- $(-2, -1)$
- $(-1, 0)$
- $(0, 1)$
- $(1, 2)$
- $(2, 3)$

(b) Evaluate  $\lim_{x \rightarrow 5} \left( (x - 5) \sin \left( \frac{1}{x - 5} \right) \right)$ .