

Math 151, Spring 2019
Common Exam 1 – Version A

LAST NAME (print): _____ FIRST NAME (print): _____

INSTRUCTOR: _____ SECTION NUMBER: _____

STUDENT ID NUMBER: _____

Directions:

1. No calculators, cell phones, or other electronic devices may be used, and they must all be put away out of sight.
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 1–20), mark the correct choice on your ScanTron using a No. 2 pencil. The ScanTrons will not be returned, therefore *for your own records, also record your choices on your exam!*
4. In Part 2 (Problems 21–24), 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

“On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work.”

Signature: _____

Part 1: Multiple Choice (3 points each)

1. Find a vector of length 6 that is *perpendicular* to the vector from point $P(-2, 1)$ to the point $Q(1, 3)$.

- (a) $\left\langle \frac{18}{\sqrt{13}}, \frac{12}{\sqrt{13}} \right\rangle$
- (b) $\left\langle -\frac{12}{\sqrt{13}}, \frac{18}{\sqrt{13}} \right\rangle$
- (c) $\left\langle -\frac{18}{\sqrt{13}}, -\frac{12}{\sqrt{13}} \right\rangle$
- (d) $\left\langle -\frac{12}{\sqrt{5}}, \frac{18}{\sqrt{5}} \right\rangle$
- (e) $\left\langle \frac{18}{\sqrt{5}}, \frac{12}{\sqrt{5}} \right\rangle$

2. A woman walks due east on the deck of a ship at 3 mph. The ship is moving due north at a speed of 18 mph. Find the direction of the woman relative to the surface of the water. Measure the angle from the positive x -axis, and assume east points in the direction of the positive x -axis.

- (a) $\arctan 6$
- (b) $\arctan \left(\frac{1}{6} \right)$
- (c) $\arctan \left(-\frac{1}{6} \right)$
- (d) $\arctan(-6)$
- (e) $\arctan \left(\frac{1}{21} \right)$

3. Find the cosine of $\angle ABC$ for the points $A(-2, 1)$, $B(1, -2)$, and $C(0, 2)$.

- (a) $-\frac{3}{\sqrt{10}}$
- (b) $\frac{6}{\sqrt{5}\sqrt{17}}$
- (c) $-\frac{5}{\sqrt{34}}$
- (d) $\frac{3}{\sqrt{10}}$
- (e) $\frac{5}{\sqrt{34}}$

4. Find the vector projection of the vector $\langle -2, 4 \rangle$ onto the vector $\langle 5, -1 \rangle$.

- (a) $\left\langle -\frac{35}{12}, \frac{7}{12} \right\rangle$
- (b) $\left\langle \frac{7}{5}, -\frac{14}{5} \right\rangle$
- (c) $\left\langle \frac{7}{3}, -\frac{14}{3} \right\rangle$
- (d) $\left\langle -\frac{35}{13}, \frac{7}{13} \right\rangle$
- (e) $\left\langle -\frac{7}{2}, \frac{7}{10} \right\rangle$

5. Find the distance from the point $(2, -3)$ to the line $y = -\frac{5}{4}x + 2$.

- (a) $\frac{33\sqrt{41}}{41}$
- (b) $\frac{10\sqrt{29}}{29}$
- (c) $\frac{33\sqrt{29}}{29}$
- (d) $\frac{10\sqrt{41}}{41}$
- (e) $\frac{7\sqrt{29}}{29}$

6. A sled is pulled along a level path by a rope. A 20-lb force acting at an angle of 30° above the horizontal moves the sled 7 ft. Find the work done by the force.

- (a) 70 J
- (b) $70\sqrt{3}$ J
- (c) 140 J
- (d) $70\sqrt{2}$ J
- (e) 35 J

7. Find parametric equations for the line through the point $(2, -9)$ that is parallel to the line $3x + 5y = 7$.

- (a) $x = 5 + 2t, y = -3 - 9t$
- (b) $x = 2 + 3t, y = -9 + 5t$
- (c) $x = 2 + 5t, y = -9 - 3t$
- (d) $x = 2 + 2t, y = 5 - 9t$
- (e) $x = 2 + 5t, y = 5 + 7t$

8. Simplify the expression $\tan(\arccos(x))$

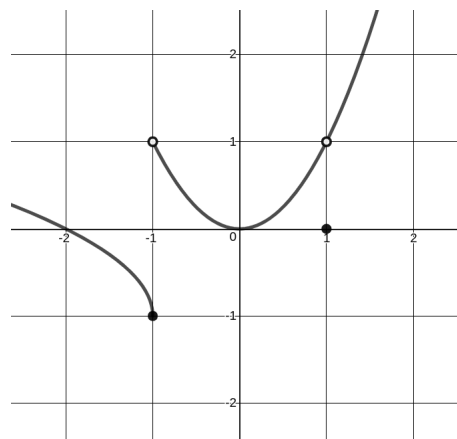
- (a) $\frac{x}{\sqrt{1-x^2}}$
- (b) $\frac{1}{\sqrt{1+x^2}}$
- (c) $\frac{x}{\sqrt{1+x^2}}$
- (d) $\sqrt{1-x^2}$
- (e) $\frac{\sqrt{1-x^2}}{x}$

9. Find the vertical asymptotes of the function $f(x) = \frac{x^2 - 5x}{x^2 - 3x - 10}$

- (a) $x = -2$ only
- (b) $x = 5$ only
- (c) $x = 0$ only
- (d) $x = -2$ and $x = 5$
- (e) $x = 0, x = -2$, and $x = 5$

10. The following is the graph of a function $y = f(x)$. Which of the following statements concerning the graph is **FALSE**?

- (a) $f(x)$ is *not* continuous at $x = 1$
- (b) $f(-1) = -1$
- (c) $f(x)$ is continuous from the left at $x = -1$
- (d) $\lim_{x \rightarrow 1} f(x)$ does not exist
- (e) $\lim_{x \rightarrow -1^+} f(x) = 1$



11. Evaluate $\lim_{x \rightarrow 2^-} \frac{3x - 7}{x^2 + x - 6}$

- (a) 0
- (b) 3
- (c) $\frac{5}{6}$
- (d) $-\infty$
- (e) ∞

12. Evaluate $\lim_{x \rightarrow -3^-} \frac{|x + 3|}{x^2 - 4x - 21}$

- (a) $-\frac{1}{10}$
- (b) $\frac{1}{10}$
- (c) 0
- (d) ∞
- (e) $-\infty$

13. Evaluate $\lim_{x \rightarrow -\infty} \ln(5x^4 + 3x^2) - \ln(2x^2 + 3x^4)$

- (a) 0
- (b) $\ln\left(\frac{5}{2}\right)$
- (c) $\ln\left(\frac{5}{3}\right)$
- (d) ∞
- (e) $-\infty$

14. Evaluate $\lim_{x \rightarrow -\infty} \frac{7x + 2}{\sqrt{4x^2 + 3}}$

- (a) 0
- (b) $\frac{7}{2}$
- (c) $\frac{7}{4}$
- (d) $-\frac{7}{2}$
- (e) $-\infty$

15. Evaluate $\lim_{x \rightarrow \infty} \frac{3e^{-2x} + 5e^{7x}}{4e^{-2x} - 6e^{7x}}$

- (a) 0
- (b) $-\frac{5}{6}$
- (c) $\frac{3}{4}$
- (d) ∞
- (e) $-\infty$

16. Which of the following statements is true regarding the equation $x^4 + 5x = 3$?

- (a) A solution exists on the interval $(0, 1)$ by the Squeeze Theorem
- (b) A solution exists on the interval $(0, 1)$ by the Intermediate Value Theorem
- (c) A solution exists on the interval $(1, 2)$ by the Squeeze Theorem
- (d) A solution exists on the interval $(1, 2)$ by the Intermediate Value Theorem
- (e) The equation has no real number solutions.

17. Which of the following statements is true concerning $\lim_{x \rightarrow 0} x^2 \sin\left(\frac{1}{x}\right)$?

- (a) $\lim_{x \rightarrow 0} x^2 \sin\left(\frac{1}{x}\right)$ does not exist since $x^2 \sin\left(\frac{1}{x}\right)$ is undefined at 0.
- (b) $\lim_{x \rightarrow 0} x^2 \sin\left(\frac{1}{x}\right)$ does not exist since $x^2 \sin\left(\frac{1}{x}\right)$ oscillates as x approaches 0.
- (c) $\lim_{x \rightarrow 0} x^2 \sin\left(\frac{1}{x}\right) = \infty$
- (d) $\lim_{x \rightarrow 0} x^2 \sin\left(\frac{1}{x}\right) = 0$ by the Intermediate Value Theorem since $-x^2 \leq x^2 \sin\left(\frac{1}{x}\right) \leq x^2$
- (e) $\lim_{x \rightarrow 0} x^2 \sin\left(\frac{1}{x}\right) = 0$ by the Squeeze Theorem since $-x^2 \leq x^2 \sin\left(\frac{1}{x}\right) \leq x^2$

18. Determine for what value of a , the following function is continuous everywhere.

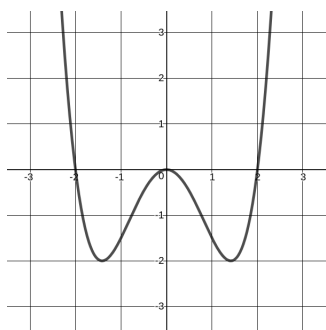
$$f(x) = \begin{cases} ax^2 + 3x & x < -2 \\ 2x - a & x \geq -2 \end{cases}$$

- (a) $\frac{2}{5}$
- (b) 0
- (c) -2
- (d) $\frac{1}{2}$
- (e) No solution.

19. The displacement (in meters) of a particle moving in a straight line is given by $s(t) = t^2 - 3t + 4$, where t is measured in seconds. Find the average velocity over the interval $[2, 5]$.

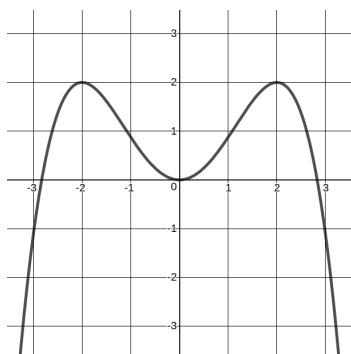
- (a) 4 m/s
- (b) $\frac{14}{5}$ m/s
- (c) $\frac{4}{3}$ m/s
- (d) 14 m/s
- (e) $\frac{9}{5}$ m/s

20. The following is the graph of $f'(x)$.

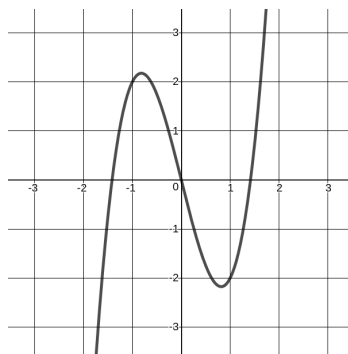


Which of the following is the graph of $f(x)$?

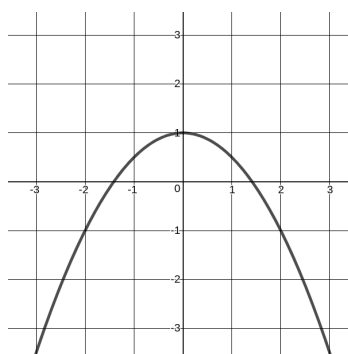
(a)



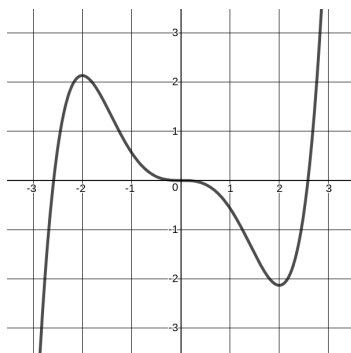
(b)



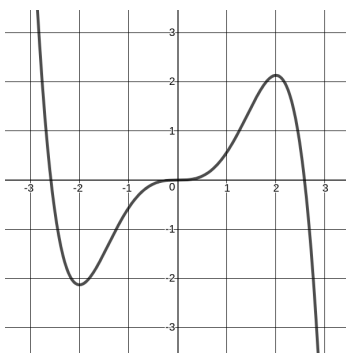
(c)



(d)



(e)



Part 2: Work out

Directions: 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.

21. (5 pts each) Evaluate the following limits

(a) $\lim_{x \rightarrow \infty} \arctan \left(\frac{4x - 3x^5}{7x^3 + 4x^4} \right)$

(b) $\lim_{x \rightarrow 5} \left(\frac{4x}{x^2 - 25} - \frac{2}{x - 5} \right)$

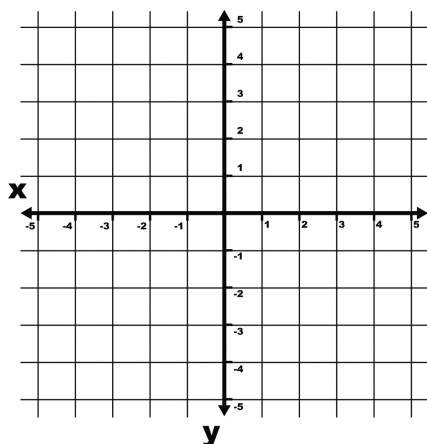
(c) $\lim_{x \rightarrow \infty} \left(2x - \sqrt{4x^2 + x} \right)$

22. (7 pts) Two forces F_1 and F_2 act on an object. The magnitude of F_1 is 4 N and it makes a 120° angle with the positive x -axis. The magnitude of F_2 is 8 N and it makes a 45° angle with the positive x -axis. Find the **magnitude** of the resultant force F . You must evaluate all trigonometric functions. You do not need to simplify the magnitude.

23. (8 pts) Consider the vector function $\mathbf{r}(t) = \langle -1 + \cos(t), 2 + \sin(t) \rangle$, where $0 \leq t \leq 2\pi$.

- (a) Eliminate the parameter to find a Cartesian Equation. Your answer must NOT contain an inverse trigonometric function.

- (b) Sketch the curve on the grid below. Include the direction of the curve as t increases.



24. (10 pts) Use the definition of the derivative to find $f'(x)$ for $f(x) = \sqrt{7+x}$. **No points will be given for any shortcut formulas used.**

FOR INSTRUCTOR USE ONLY

Problem	Points Awarded	Points
1–20		60
21		15
22		7
23		8
24		10
Total		100