Directions:

- Do not remove this page—you will turn in the entire exam. You have two hours to do this exam. No books or notes may be used. You may use a graphing calculator during the exam, but NO calculator with a Computer Algebra System (CAS) or a QWERTY keyboard is permitted. Absolutely no cell phone use during the exam is allowed.

- The exam consists of multiple choice and short answer questions. Record your answers on this page by filling in the appropriate selection, for example:

- The exam is out of 100 total points: 5 points for each of 20 questions. **Only** this front page will be graded and no partial credit will be awarded. It is recommended that you check your work!

1. A B C D E
2. A B C D E
3. A B C D E
4. A B C D E
5. A B C D E
6. A B C D E
7. A B C D E
8. A B C D E
9. A B C D E
10. A B C D E
11. A B C D E
12. A B C D E
13. A B C D E
14. A B C D E
15. −3
16. 2x + h
17. 69\pi \text{ cm}^2
18. (1, 3)
19. 79
20. 1

For grading use:

| Total | (out of 100 pts) |
Multiple Choice: Show your work in the space below and shade the correct answer on the front page for each of the following.

1. Determine the number of solutions to the system \[
\begin{align*}
3x - 8y &= -8 \\
x + y &= 1
\end{align*}
\]

Choices:
(a) One real solution
(b) No real solutions
(c) Four real solutions
(d) Two real solutions
(e) Infinitely many real solutions

2. Which is the full set of solutions to \(4x + 7 \leq 15\)?

Choices:
(a)
(b)
(c)
(d)
(e)
3. Let \( f(x) = \frac{1}{3x - 7} \). Find the domain of \( f(x) \).

**Choices:**

(a) \((-\infty, 3) \cup (7, \infty)\)
(b) \((-\infty, \infty)\)
(c) \((-\infty, \frac{7}{3}) \cup \left(\frac{7}{3}, \infty\right)\)
(d) \([7, \infty)\)
(e) \(\left[\frac{7}{3}, \infty\right)\)

4. Let \( f(x) = \frac{2}{x - 3} \). Find \( f(a + 1) \).

**Choices:**

(a) \(\frac{2}{a - 2}\)
(b) \(\frac{2}{a - 3} + 1\)
(c) \(\frac{3}{a - 3}\)
(d) \(\frac{2}{a - 3}\)
(e) \(\frac{2}{x - 3} \cdot (a + 1)\)

5. Use the Intersect or Intercept Method to approximate all real solutions to the equation below using your calculator.

\[ x^2 = \sqrt{x + 5} \]

**Choices:**

(a) \(x \approx -1.3794 \) and \( x \approx 1.6030\)
(b) \(x \approx -1.3794 \) and \( x \approx 1.9028\)
(c) \(x \approx -1.2766 \) and \( x \approx 1.4894\)
(d) \(x \approx 1.6030 \) and \( x \approx 2.5696\)
(e) \(x \approx -1.2766 \) and \( x \approx 1.6297\)
6. Determine all solutions to the system \[
\begin{aligned}
(x - 3)^2 + (y - 2)^2 &= 9 \\
x - y &= -2
\end{aligned}
\]

Choices:
(a) \((1, 2 + \sqrt{5})\)
(b) \((6, 8)\)
(c) \((1, 3)\)
(d) \((0, 2), (3, 5)\)
(e) \((3, -1), (6, 2)\)

7. How many real solutions does the equation \(x^4 - x - 4 = 2x + 4\) have?

Choices:
(a) Exactly four real solutions.
(b) Exactly two real solutions.
(c) Exactly one real solution.
(d) The equation has no real solutions.
(e) Exactly three real solutions.

8. Which of the following statements best describes the system of equations? \[
\begin{aligned}
6x - 3y &= 3 \\
2x - y &= 1
\end{aligned}
\]

Choices:
(a) The system is dependent. Two solutions to the system are \((1, 1)\) and \((3, 5)\). One point that is NOT a solution to the system is \((0, 0)\).
(b) The system is dependent. Two solutions to the system are \((4, 5)\) and \((2, 7)\). One point that is NOT a solution to the system is \((1, 1)\).
(c) The system is consistent. It has exactly one solution which is \((1, 1)\).
(d) The system is dependent. Every point is a solution to the system.
(e) The system is inconsistent. Therefore the system has no solutions.
9. How many liters of a 15% solution of acid must be mixed with 10 liters of a 24% solution of acid to produce an 18% solution of acid?

Choices:
(a) \( \frac{70}{3} \) liters.
(b) The final solution can not be obtained.
(c) \( \frac{1}{2} \) liters.
(d) 10 liters.
(e) 20 liters.

10. A corner lot has dimensions 75 by 120 feet. The city plans to take a strip of uniform width along the two sides bordering the streets to widen these roads. The width of the strip is \( w \) feet, as shown in the picture. The area of the new lot is 8050 square feet. To find \( w \), which of the following equations would you solve?

\[
120 \text{ feet} \\
\text{w} \\
\text{w} \\
75 \text{ feet}
\]

Choices:
(a) \( 75 \cdot 120 = 8050 + w \)
(b) \( 9000w = 8050 \)
(c) \( 8050 - w = 9000 \)
(d) \( 75(120 - w) = 950 \)
(e) \( (75 - w)(120 - w) = 8050 \)

11. Which one of the following equations can not be solved algebraically and so must be solved graphically?

Choices:
(a) \( \frac{1}{x+1} - \frac{5}{x-3} = 10 \)
(b) \( x^2 - x + 1 = 5x + 10 \)
(c) \( 3x^7 - 1 = 0 \)
(d) \( x^5 + x^4 = x^2 - 1 \)
(e) \( \sqrt{x-2} = 5x \)
12. A ball is thrown straight upward at an initial speed of 192 ft/sec. From physics, it is known that after \( t \) seconds the ball reaches a height \( h \) feet given by the formula

\[
h = -16t^2 + 192t.
\]

When is the ball more than 560 feet above the ground?

**Choices:**
(a) Between 0 and 4 seconds and also after 6 seconds
(b) Only at 6 seconds
(c) Between 4 seconds and 6 seconds
(d) Between 5 seconds and 7 seconds
(e) Between 0 and 5 seconds and also after 7 seconds

13. Which is the full set of solutions to \(|7 - x| \leq 3|\)?

**Choices:**
(a) \((-\infty, 3] \cup [7, \infty)\)
(b) \((-\infty, 4] \cup [10, \infty)\)
(c) \([4, 10]\)
(d) \([3, 7]\)
(e) \([-10, -4]\)

14. Which is the full set of solutions to \(\frac{x + 4}{x - 2} \geq 3\)?

**Choices:**
(a) \([2, 5]\)
(b) \((2, 5]\)
(c) \((-\infty, 2) \cup (5, \infty)\)
(d) \([5, \infty)\)
(e) \((-\infty, 5]\)
15. Let

\[ f(x) = \begin{cases} 
3x - 1 & \text{if } x \leq -2 \\
x^2 & \text{if } -2 < x \leq 1 \\
-2x + 1 & \text{if } x > 1 
\end{cases} \]

Find \( f(2) \).

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16. Let \( f(x) = x^2 - 1 \). Find \( \frac{f(x+h) - f(x)}{h} \) and simplify. (Assume \( h \neq 0 \).)

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17. A circle has a radius of 10 centimeters. If the radius increases by 3 centimeters, by how much does the area of the circle increase?
18. Suppose you are given a system of equations whose graphs are shown in the picture below. Determine an approximate solution to this system.

\begin{itemize}
\item \[ y = \frac{1}{4}x + 2 \]
\item \[ y = \frac{2}{3}x + 1 \]
\item \[ y = \frac{1}{2}x - 3 \]
\item \[ y = \frac{1}{1}x - 4 \]
\end{itemize}

\begin{figure}[h]
\centering
\includegraphics[width=0.6\textwidth]{system_of_equations_graph.png}
\caption{Graphs of the system of equations.}
\end{figure}

19. Let \( f(x) = x^2 - \sqrt{x} + 1 \). Find \( f(9) \).

20. The graph of \( y = g(x) \) is shown below. Use the graph to answer the question.

\begin{itemize}
\item What is \( g(-1) \)?
\end{itemize}

\begin{figure}[h]
\centering
\includegraphics[width=0.6\textwidth]{function_graph.png}
\caption{Graph of the function \( y = g(x) \).}
\end{figure}