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:

  A B C D E.

- 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!

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 5. | A | B | C | D | E | 16. | 4 |
| 6. | A | B | C | D | E | 17. | (1, -3) |
| 7. | A | B | C | D | E | 18. | v \cdot \omega / (\omega + \nu) |
| 8. | A | B | C | D | E | 19. | \pm 2, \pm 1 |
| 9. | A | B | C | D | E | 20. | \pm \frac{\pi}{2} |

For grading use:

<table>
<thead>
<tr>
<th>Total</th>
<th></th>
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<tbody>
<tr>
<td>(out of 100 pts)</td>
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</table>
1. Solve the following equation for $x$.

$$3x^2 - 5x - 1 = 0$$

$$x = \frac{5 \pm \sqrt{25 + 12}}{6} = \frac{5 \pm \sqrt{37}}{6}$$

Choices:

(a) $\frac{1 \pm \sqrt{13}}{2}$
(b) $\frac{5 \pm \sqrt{37}}{6}$
(c) $-5 \pm \sqrt{37}$
(d) There are no real solutions.
(e) $\frac{5 \pm \sqrt{13}}{6}$

2. Which one of the following points is on the graph of the equation $x - 2y = 5$?

Choices:

(a) (0, 5)
(b) (1, 4)
(c) (-1, -6)
(d) (-1, 6)
(e) (-2, -1)

(a) $0 - 2(5) = 0 \neq 5$
(b) $1 - (1)^2 (4) = 1 - 4 = -3 \neq 5$
(c) $-1 - (-1)^2 (-6) = -1 + 6 = 5 \checkmark$
(d) $-1 - (1)^2 (6) = -1 - 6 = -7 \neq 5$
(e) $-2 - (-2)^2 (-1) = -2 + 4 = 2 \neq 5$
3. Solve the following equation for $s$.

\[ 8(3 - s)^2 = 16 \]

\[ \frac{8}{8} \]

Choices:
(a) \( \pm \sqrt{5} \)
(b) \( \sqrt{8} \)
(c) \( \sqrt{2} \)
(d) The equation can not be solved for $s$.
(e) \( 3 \pm \sqrt{2} \)

\[ (3 - s)^2 = 2 \]

\[ 3 - s = \pm \sqrt{2} \]

\[ 3 \pm \sqrt{2} = 5 \]

4. Solve the following equation for $x$.

\[ \left( \frac{\sqrt{2x-1}}{x-2} \right)^2 \]

Choices:
(a) The equation has no solutions.
(b) $x = 1$ only.
(c) $x = 1$ and $x = 5$.
(d) $x = 5$ only.
(e) $x = -3$ and $x = 2$.

\[ 2x - 1 = x^2 - 4x + 4 \]

\[ 0 = x^2 - 6x + 5 = (x - 5)(x - 1) \]

\[ x = 5, \quad x = -1 \] (check answers)

\[ x = -1 \]

\[ \sqrt{2(5) - 1} = 5 - 2 \quad \sqrt{2(1) - 1} = -1 - 2 \]

\[ \sqrt{9} = 3 \sqrt[4]{-3} = -3 \]

5. Solve the following equation for $x$.

\[ x^2(x^2 + 5) = 0 \]

Choices:
(a) The equation has no solutions.
(b) $x = 0$ only.
(c) $x = \sqrt[4]{-5}$ only.
(d) $x = 0$ and $x = \sqrt[4]{-5}$.
(e) $x = \pm \sqrt[4]{-5}$ only.

\[ x = 0 \quad x^3 + 5 = 0 \]

\[ x = 0 \quad x = \frac{3}{\sqrt{-5}} \]
6. Find the value of \( k \) that makes the following expression a perfect square.

\[
x^2 - 8x + k.
\]

\[
\frac{-6}{2} = -3
\]

\[
x^2 - 6x + k \rightarrow (-3)^2 = 9
\]

\[
= (x - 3)^2
\]

Choices:
- (a) 3
- (b) 9
- (c) \( \frac{9}{4} \)
- (d) -9
- (e) -9

7. Solve the following equation for \( x \).

\[
|x + 5| = 2
\]

\[
|x - (-5)| = 2 \quad \text{distance from } \quad x \text{ to } -5 \text{ is 2}
\]

Choices:
- (a) \( x = -3 \) and \( x = -7 \).
- (b) \( x = -3 \) only.
- (c) \( x = 3 \) only.
- (d) \( x = 7 \) only.
- (e) \( x = -1 \) only.

8. Find the distance between the points \((-2, 1)\) and \((1, -3)\).

Choices:
- (a) \( \sqrt{5} \)
- (b) \( \sqrt{7} \)
- (c) 5
- (d) \( \pm 5 \)
- (e) 25

\[
d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}
\]

\[
d = \sqrt{(-2 - 1)^2 + (1 - (-3))^2}
\]

\[
= \sqrt{(-3)^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5
\]
9. Find the exact value of

\[ |\sqrt{2} - 3| = \sqrt{2} - 3 < 0 \]

So

\[ 1 |\sqrt{2} - 3| = - (\sqrt{2} - 3) = 3 - \sqrt{2} \]

Choices:

(a) \( \sqrt{2} + 3 \)
(b) \( 3 - \sqrt{2} \)
(c) 1.5858
(d) \( -3 + \sqrt{2} \)
(e) -1

10. Find \( k \) so that the following equation has only one solution.

\[ x^2 - 3x + k = 0 \]

\[ b^2 - 4ac = 0 \]

\[ (-3)^2 - 4(1)(k) = 0 \]

\[ 9 - 4k = 0 \]

\[ k = \frac{9}{4} \]

Choices:

(a) \( -\frac{4}{9} \)
(b) \( \frac{9}{4} \)
(c) 9
(d) \( \frac{3}{2} \)
(e) 0

11. Find the equation of a circle with center \((5, 1)\) such that the point \((3, 7)\) is on the circle.

Choices:

(a) \( (x - 2)^2 + (y + 7)^2 = 4 \)
(b) \( (x - 5)^2 + (y - 1)^2 = 6 \)
(c) \( (x - 2)^2 + (y - 7)^2 = 4 \)
(d) \( (x + 5)^2 + (y + 1)^2 = 49 \)
(e) \( (x - 5)^2 + (y - 1)^2 = 36 \)

\[ y = \sqrt{(5 - 5)^2 + (1 - 7)^2} \]

\[ \Delta = x^2 + y^2 = 36 = 6 \]

\[ (x - 5)^2 + (y - 1)^2 = 6^2 \]
12. How many distinct real solutions does the equation $x^3 - x^2 + 4x - 4 = 0$ have?

**Choices:**

(a) Two real solutions.
(b) One real solution.
(c) Four real solutions.
(d) Three real solutions.
(e) No real solutions.

\[
\begin{align*}
x^2(x-1) + 4(x-1) &= 0 \\
(x^2+4)(x-1) &= 0 \\
x^2+4 &= 0 \quad \text{no solution} \\
x-1 &= 0 \quad \text{one solution}
\end{align*}
\]

13. Find the $x$ and $y$-intercepts of the graph of 

\[x+y^2-4=0\]

**Choices:**

(a) The $x$ intercepts are $x = 2$ and $x = -2$ and the $y$ intercept is $y = 4$.
(b) The $x$ intercept is $x = 4$ and the $y$ intercept is $y = 2$.
(c) The $x$ intercept is $x = 4$ and there are no $y$ intercepts.
(d) The $x$ intercept is $x = 4$ and the $y$ intercepts are $y = 2$, and $y = -2$.
(e) The $x$ intercept is $x = -4$ and the $y$ intercepts are $y = 2$, and $y = -2$.

\[
\begin{align*}
\text{y-int: } y &= 0 \\
x-4 &= 0 \\
x &= 4
\end{align*}
\]

14. Which one of the following statements is not true?

**Choices:**

(a) $\sqrt{x^2} = x$ for all real numbers $x$.
(b) $|x - y| = |y - x|$ for all real numbers $x$ and $y$.
(c) $a$ has two square roots for all real numbers $a > 0$.
(d) $|a|$ can never be negative for all real numbers $a$.
(e) $\sqrt{a^2} = |a|$ for all real numbers $a$.

15. Which one of the equations represents the statement that the distance from $-2$ to a number $x$ on the number line is 7?

**Choices:**

(a) $|x - (-2)| = 7$
(b) $|7 + x| = 2$
(c) $|x - 2| = 7$
(d) $|x + 2| = 7$
(e) $|7 - 2| = x$
16. Solve the equation for \( x \). Include all solutions in your answer on the front of the exam.

\[
L.C.O. = (x+1)(x+3) \quad \frac{1}{x+1} + \frac{3}{(x+1)(x+3)} = \frac{2}{x+3}
\]

\[
(x+1)(x+3) \left( \frac{1}{x+1} + \frac{3}{(x+1)(x+3)} \right) = \left( \frac{2}{x+3} \right) (x+1)(x+3)
\]

\[
x+3 + 3 = 2(x+1)
\]

\[
x + 6 = 2x + 2.
\]

\[
4 = x
\]

17. Find the center of the circle

\[
x^2 - 2x + y^2 + 6y - 10 = 0.
\]

\[
\frac{-2}{2} = -1
\]

\[
(-1)^2 = 1
\]

\[
\frac{b}{2} = 3
\]

\[
(3)^2 = 9
\]

\[
(x-1)^2 + (y + 3)^2 = 20
\]

Center = \((1, -3)\)

18. Solve the equation for \( R \). 

\[
L.C.O. = R V W
\]

\[
\frac{1}{R} = \frac{1}{V} + \frac{1}{W}
\]

\[
R V W \left( \frac{1}{R} \right) = \left( \frac{1}{V} + \frac{L}{W} \right) R V W
\]

\[
V W = R W + R V
\]

\[
V W = R (w + v)
\]

\[
\frac{V W}{w + v} = \frac{R}{R}
\]
19. Find all real solutions to the equation \( x^4 - 5x^2 + 4 = 0 \).

\[
\begin{align*}
\mathcal{U} &= x^2 \\
\mathcal{U} &= x^4 \\
\mathcal{U}^2 - 5\mathcal{U} + 4 &= 0 \\
(\mathcal{U} - 4)(\mathcal{U} - 1) &= 0 \\
\mathcal{U} &= +4 \quad \mathcal{U} = 1 \\
x^2 &= 4 \quad x^2 = 1 \\
x &= \pm 2 \quad x = \pm 1
\end{align*}
\]

20. Solve for \( s \).

\[
\begin{align*}
5 \left( \frac{8 - 2s}{5} \right) &= 17 \left( \frac{5}{5} \right) \\
8 - 2s &= 85 \\
-2s &= 77 \\
s &= -\frac{77}{2}
\end{align*}
\]