Part I. Problems in this section are mostly short answer and multiple choice. Little partial credit will be given. 4 points each.

1. Find product. Express in $a + bi$ form.

$$(2 - 5i)^2$$

2. Find the quotient and remainder.

$$(2x^3 - 4x^2 - 5) \div (x + 2)$$

3. State the center and radius.

$$x^2 + (y - 3)^2 = 10$$

center = ___________________ radius: ___________________

4. Complete the following table.

<table>
<thead>
<tr>
<th>Inequality</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x \leq -2$</td>
<td></td>
</tr>
<tr>
<td>$x \neq 3$</td>
<td></td>
</tr>
<tr>
<td>(-2, -4]</td>
<td></td>
</tr>
<tr>
<td>(2, $\infty$)</td>
<td></td>
</tr>
</tbody>
</table>
5. Factor completely.
   a) \(3x^3 - 48x\)
   b) \(x^4 - 3x^2 - 10\)

6. Find the domain of the function \(g(x) = \frac{x-2}{x+2}\):
   a) \((-2, 2)\)
   b) \((-\infty, -2) \cup (-2, \infty)\)
   c) \((-\infty, -2)\)
   d) \(-2, \infty\)
   e) \((-\infty, -2]\)

7. Given the graph of \(f(x)\), state the interval(s) on which:
   a) \(f(x)\) is decreasing

   b) \(f(x) \geq 0\)
8. Solve: \[ \left| \frac{x-5}{2} \right| = 3 \]

9. Let \( f(x) = 4x - 3 \) and \( g(x) = x^2 + 1 \).

Find and simplify.

a) \( (g \circ f) \left( \frac{-1}{2} \right) \)

b) \( (f - g)(x) \)

10. Solve for \( x \): \( y = \frac{x-3}{2x+1} \)
11. Find the linear function $f$ such that $f(2) = -5$ and $f(4) = 1$.

$$m = \ldots$$

$$f(x) = \ldots$$

12. State the vertex of each.

a) $y = x^2 + 1$

b) $y = (x - 2)^2$

c) $y = x^2 + 4x + 5$

$v$: \ldots $v$: \ldots $v$: \ldots
13. Match each equation with the appropriate graph.

Note: *Option 5 - Not Shown – may be used as many times as necessary.

_____ A) \( y = \log_2(x + 1) \)  

_____ B) \( y = e^{-x} \)  

_____ C) \( y = -e^x \)  

_____ D) \( y = \left( \frac{1}{3} \right)^x + 2 \)  

_____ E) \( y = \ln(-x) \)
14. Find \( f(x) = \sqrt[3]{\frac{2x - 5}{4}} \)

\[ f^{-1}(x) = \text{___________} \]

15. Solve for \( x \).
   a) \( \left(\frac{1}{4}\right)^x = 8^{2x-3} \)
   b) \( \log(3x - 5) = 2 \)

16. Given the function \(-2(x + 1)(x - 3)^2\),
   a) Find \( y \)-intercept.
   b) Find zeros and state their multiplicities.
      \[
      \begin{array}{c|c}
      \text{zero} & \text{multiplicity} \\
      \hline
      \end{array}
      \]
   c) Is \( f(x) \) tangent to the \( x \)-axis? If so, where?
   d) Sketch graph. Label all intercepts.
17. Given \( f(x) = x^2 - 3x \), find and simplify \( \frac{f(x+h) - f(x)}{h} \).

18. Given the polynomial \( g(x) = x^3 - 4x^2 + 8x - 8 \),
   a) state all possible rational zeros.
   b) state \( g(x) \) in factored form.
   c) find all zeros (real and complex.)
19. Find all asymptotes, x-intercepts, and y-intercepts for the graph \( \frac{-2}{x^2 - 4} \).

   a) The equation of the vertical asymptote(s) is/are \( x = \) _______.

   b) The equation of the horizontal asymptote(s) is/are \( y = \) _______.

   c) The x-intercept is at the point ______________.

   d) The y-intercept is at the point ______________.

   e) Sketch the graph of \( f(x) \). Label all intercepts, asymptotes, and any additional points you found to help improve your graph.

\[ \frac{2x}{x+3} + \frac{5}{x} - 4 = \frac{18}{x^2 + 3x} \]

20. Solve for \( x \).
21. Solve $\sqrt{6x+7} = x + 2$. Check all solutions.

22. Solve the system
   \begin{align*}
   3x + 4y &= 6 \\
   2x + 3y &= 5
   \end{align*}

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**Part III. There are 6 problems in this section. Choose any 4. Indicate in the boxes the problems you want graded. 8 points each.**

☐ 23. Graph the following function.

$f(x) = \begin{cases} 
-2x + 1, & x < 0 \\
3x, & x \geq 0
\end{cases}$
24. Solve for \( x \). \( \log_3(x + 3) + \log_3(x + 5) = 1 \)

25. Carbon dating. The amount (in percent) of carbon \(-14\) in animal bones after \( t \) years is given by \( P(t) = P_0e^{-0.00012t} \). A bone has lost 75% of its carbon \(-14\). What is the age of the bone? Leave answer in exact form.
26. A rancher has 200 yds of fence with which to enclose two adjacent rectangular corrals. A river forms one side of the corrals (see figure to the right).

a) If $x$ represents the width of each corral, represent the length in terms of $x$.

b) Find $A(x)$.

c) Determine the value of $x$ that yields maximum area.
27. Solve \( \frac{2x - 1}{x + 3} < 0 \). Express in interval form. To receive full credit you must show work that supports your answer.

28. Solve the system.

\[
\begin{align*}
5x + 2y - z &= -7 \\
x - 2y + 2z &= 0 \\
3y + z &= 17
\end{align*}
\]