Each of the 20 questions is worth five points. To get full/partial credit show all your work.

Exam A Q1 / Exam B Q18

1. Use **long division** to divide \((x^3 - 4x^2 + x + 6) \div (x - 4)\).

\[
\begin{array}{c|ccccc}
\multicolumn{1}{r}{x^2 + 1} & x^3 & -4x^2 & +x & +6 \\
\hline
x-4 & x^3 & -4x^2 & \phantom{+}x & +6 \\
\hline
& -x^3 & +4x^2 & \phantom{+}0 & +6 \\
\hline
& & 0 & +x & +6 \\
\hline
& & & -x & -4 & \\
\hline
& & & & 10 \\
\hline
\end{array}
\]

= \(x^2 + 1 + \frac{10}{x-4}\)

Exam A Q2 / Exam B Q19

2. Given \(f(x) = x^4 + x^3 - 6x^2 - 5x - 15\), use the **Remainder Theorem** to evaluate \(f(-3)\).

\[
\begin{array}{c|ccccc}
\multicolumn{1}{r}{-3} & 1 & 1 & -6 & -5 & -15 \\
\hline
& 1 & 4 & -6 & 15 \\
\hline
& 1 & 2 & 0 & -5 & 0 \\
\hline
\end{array}
\]

\(f(-3) = 0\)

Exam A Q3 / Exam B Q20

3. Based on your answer to #2, is \((x + 3)\) a factor of \(f(x)\)? Explain your reasoning.
   Yes. Because the remainder is zero.

Exam A Q4 / Exam B Q16

4. For \(f(x) = \frac{4x-9}{x^2-9}\), find ;
a. vertical asymptotes  
\[ x^2 - 9 = 0 \]  
\[ x^2 = 9 \]  
\[ x = \pm 3 \]

b. horizontal asymptote  
\[ y = 0 \]

Exam A Q5 / Exam B Q6

5. Suppose that \( E \)nergy \( E \) varies directly as the square of \( velo\text{c}i\text{ty} \( v \) of the wind. Write a variation model using \( k \) as the constant of variation.

\[ E = kv^2 \]

Exam A Q6 / Exam B Q5

6. Use the definition of a one-to-one function to determine whether \( m(x) = x^2 - 4 \) is \textbf{one-to-one}.

\[ m(a) = a^2 - 4 \]
\[ m(b) = b^2 - 4 \]

\begin{align*}
  m(a) &= m(a) \\
  a^2 - 4 &= b^2 - 4 \\
  a^2 &= b^2 \\
  a &= -b, b
\end{align*}

No, not one-to-one.

Exam A Q7 / Exam B Q7

7. Using function composition, determine whether the functions \( f(x) = 5x + 4 \) and \( g(x) = \frac{x-4}{5} \) are inverses of each other.

\begin{align*}
  (f \circ g)(x) &= 5\left(\frac{x-4}{5}\right) + 4 \\
  &= x - 4 + 4 = x \\
  (g \circ f)(x) &= \frac{(5x+4) - 4}{5} \\
  &= \frac{5x}{5} = x
\end{align*}

Hence the two functions are inverses
Use the graph on the right to answer #s 8 and 9.

Exam A Q8 / Exam B Q9

8. (a) As \( x \to \infty \), \( f(x) \to \underline{\phantom{0}}0\).
(b) As \( x \to -\infty \), \( f(x) \to \underline{\phantom{0}}0\).

Exam A Q9 / Exam B Q10

9. (a) As \( x \to -3^- \), \( f(x) \to -\infty \)
(b) As \( x \to -3^+ \), \( f(x) \to \infty \)

Exam A Q10 / Exam B Q17

10. Suppose that $10,000 is invested at the rate of 5% compounded monthly. Write an expression for the total amount in the account after 10 years. Do not simplify your expression.

\[
P = 10,000, \quad r = 0.05, \quad n = 12, \quad t = 10
\]

\[
A = p \left(1 + \frac{r}{n}\right)^{nt} = 10,000 \left(1 + \frac{0.05}{12}\right)^{12 \cdot 10}
\]

Refer to #s 11 and 12, given \( m(x) = -4(x - 2)(x + 1)^2(x + 6)^4 \), determine:

Exam A Q11 / Exam B Q12

11 a. the leading term
\( -4x^7 \)

b. the end behavior of the graph of the function
down right, up left

Exam A Q12 / Exam B Q13

12. The zeros of \( m(x) \) and state their multiplicities.

\[
\begin{array}{ccc}
x - 2 = 0 & x + 1 = 0 & x + 6 = 0 \\
x = 2 & x = -1 & x = -6 \\
\text{multiplicity} = 1 & \text{multiplicity} = 2 & \text{multiplicity} = 4 \\
\end{array}
\]

Exam A Q13 / Exam B Q14

13. Factor \( g(x) = x^3 - 4x^2 + x + 6 \) completely, given that 2 is a zero of \( g(x) \).
14. Write a polynomial of degree 3 with zeros 1, $-6$, and 3. Leave this polynomial in factored form.
   \[ f(x) = (x-1)(x+6)(x-3) \]

15. Solve the inequality and write your answer in interval notation.
   \[ x^2 - 5x \geq -6 \]
   \[ x = 2, 3 \]
   \[ (-\infty, 2] \cup [3, \infty) \]

16. The graph of a function $y = f(x)$ is given as below. Is the function one-to-one? Justify your answer.
Yes. Because it satisfies the horizontal line test.

Exam A Q17 / Exam B Q11

17. The number of people that a ham can serve varies directly as the weight of the ham. 8 lb ham feeds 20 children. How many people will 10 lb ham feed?

\[ p = k h \]
\[ 20 = 8k \]
\[ k = \frac{5}{2} \]
\[ p = \frac{5}{2} h \]
\[ p = \frac{5}{2} \cdot 10 = 25 \]

Hence number of people = 25.

Exam A Q18 / Exam B Q2

18. Find the inverse function of \( f(x) = \sqrt[3]{x - 4} \).

\[ f(x) = \sqrt[3]{x - 4} \]
\[ y = \sqrt[3]{x - 4} \]
\[ x = \sqrt[3]{y - 4} \]
\[ x^3 = y - 4 \]
\[ y = x^3 + 4 \]
\[ f^{-1}(x) = x^3 + 4 \]

Exam A Q19 / Exam B Q1

19. Solve \( \frac{x}{x-2} \geq 0 \), leave your answer in interval notation.

\[ x = 0, 2 \]

---

\[ x = 0, 2 \]
20. Graph the function $f(x) = 2^x$. 

<table>
<thead>
<tr>
<th>$x$</th>
<th>$f(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>$\frac{1}{4}$</td>
</tr>
<tr>
<td>-1</td>
<td>$\frac{1}{2}$</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
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<tr>
<td>1</td>
<td>2</td>
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