Foundations of Mathematics and Pre-Calculus 10

Sample Questions for Algebra and Number

Instructions

1. You may require a protractor and a ruler (metric and imperial) for paper versions of the questions.

2. You may use math tiles.

3. When using your calculator (scientific or approved graphing calculator):
   • use the programmed value of $\pi$ rather than the approximation of 3.14.
   • round only in the final step of the solution.

4. Diagrams are not necessarily drawn to scale.

5. For questions marked with $\square$, do not use your calculator.
**PART A: MULTIPLE-CHOICE QUESTIONS**

1. Which of the following powers is a perfect cube?

   A. $3^2$
   B. $5^6$
   C. $6^4$
   D. $9^2$

2. Write as a single power: $\frac{12^3}{4^3}$

   A. $3^0$
   B. $3^3$
   C. $8^3$
   D. $48^6$

3. Given $x > 1$, arrange from the least to the greatest:

   $\sqrt{x}, \frac{1}{\sqrt[3]{x}}, \frac{3}{\sqrt{x}}$

   A. $\frac{1}{\sqrt[3]{x}}, \sqrt{x}, \frac{3}{\sqrt{x}}$
   B. $\frac{1}{\sqrt[3]{x}}, \frac{3}{\sqrt{x}}, \sqrt{x}$
   C. $\sqrt{x}, \frac{3}{\sqrt{x}}, \frac{1}{\sqrt[3]{x}}$
   D. $\frac{3}{\sqrt{x}}, \frac{1}{\sqrt[3]{x}}, \sqrt{x}$
4. Two gears are shown below in their starting position.
   - Gear 1 has 6 teeth.
   - Gear 2 has 8 teeth.
   - As Gear 1 turns, it causes Gear 2 to turn at a different rate.
   - Gear 1 is rotated until the two gears are back to this starting position.

   Starting Position:

   What is the minimum number of rotations Gear 1 requires to return to this starting position?
   A. 48 rotations
   B. 24 rotations
   C. 4 rotations
   D. 2 rotations

5. Three students were asked to show steps for simplifying \( \sqrt[3]{1080} \) to \( 6 \sqrt[5]{5} \).

<table>
<thead>
<tr>
<th>Jean</th>
<th>Sally</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sqrt[3]{1080} = \sqrt[3]{2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 5} )</td>
<td>( \sqrt[3]{1080} = \sqrt[3]{216 \times 5} )</td>
<td>( \sqrt[3]{1080} = \sqrt[3]{27 \times 5 \times 8} )</td>
</tr>
<tr>
<td>( = (2 + 3)(\sqrt[5]{5}) )</td>
<td>( \sqrt[3]{216} = 6 )</td>
<td>( = 3 \times \sqrt[5]{5} \times 2 )</td>
</tr>
<tr>
<td>( = 6 \sqrt[5]{5} )</td>
<td>( \therefore \sqrt[3]{1080} = 6 \sqrt[5]{5} )</td>
<td>( = 6 \sqrt[5]{5} )</td>
</tr>
</tbody>
</table>

Which student made a mistake, if any?
   A. Jean
   B. Sally
   C. Mark
   D. All of them show correct work.
6. Simplify: \( \left( \frac{-54x^6y}{2x^{-3}y^{4}} \right)^{\frac{4}{3}} \)

A. \(-36x^4y^4\)
B. \(-\frac{36x^{12}}{y^4}\)
C. \(81x^4y^4\)
D. \(\frac{81x^{12}}{y^4}\)

7. Determine a simplified expression for the lateral surface area of the prism below.

A. \(8x^2 + 16x\)
B. \(8x^2 + 20x + 8\)
C. \(16x^2 + 16x - 2\)
D. \(4x^3 + 8x^2 - x - 2\)
8. Determine an expression for the area of the largest square in the diagram below.

![Diagram](image)

A. $4x^2 + 25$
B. $4x^2 - 20x + 25$
C. $5x^2 + 26$
D. $5x^2 - 18x + 26$

9. Derek expanded and simplified $(x - 3)(2x^2 + 5x - 8)$ as shown below.

<table>
<thead>
<tr>
<th></th>
<th>$x$</th>
<th>$-3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2x^2$</td>
<td>$2x^3$</td>
<td>$-6x^2$</td>
</tr>
<tr>
<td>$+ 5x$</td>
<td>$5x^2$</td>
<td>$-15x$</td>
</tr>
<tr>
<td>$- 8$</td>
<td>$-8x$</td>
<td>$-24$</td>
</tr>
</tbody>
</table>

In which step is Derek’s first mistake?

A. Step I
B. Step II
C. Step III
D. Step IV
10. When $5x^2 - 20$ is factored, how many factors are in the result?

A. 2  
B. 3  
C. 4  
D. 5

11. One of the factors of $3x^2 - 16x + k$ is $(x - 7)$. Determine the value of $k$.

A. –35  
B. –9  
C. 5  
D. 63

12. When factoring $x^2 - 7x + 6$ to the form $(x + a)(x + b)$, which two of the following characteristics are true?

<table>
<thead>
<tr>
<th></th>
<th>( ab = -7 )</th>
<th>( a + b = 6 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>( ab = 6 )</td>
<td>( a + b = -7 )</td>
</tr>
<tr>
<td>III</td>
<td>( a &gt; 0 ) and ( b &gt; 0 )</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>( a &lt; 0 ) and ( b &lt; 0 )</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>( a &gt; 0, \ b &lt; 0 ) or ( a &lt; 0, \ b &gt; 0 )</td>
<td></td>
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</tbody>
</table>

A. I and III  
B. I and IV  
C. II and IV  
D. II and V
13. Which of the following areas formed by math tiles is factorable?

A.  

B.  

C.  

D.
14. Determine the missing tiles, labelled \( w \), in the tile model below.

A. 

B. 

C. 

D. 

PART B: NUMERIC-RESPONSE QUESTIONS

15. Given \( \sqrt[\frac{1}{2}]{x^{10}} = x^2 \), determine the value of \( n \). Answer to the nearest integer.

Record your answer neatly on the Answer Sheet.
16. When \( \left( \frac{4}{5} \right)^{\frac{7}{10}} \left( \frac{5}{7} \right)^{\frac{3}{5}} \) is simplified to \( 7^n \), determine the value of \( n \). Answer to two decimal places.

Record your answer neatly on the Answer Sheet.