Date Completed: _____
Mentor Initials: _____

Exponents and Radicals (Advanced)

1. For a positive real number z, where $z^6 = 3$, what is the value of z^{18} ?

A. $\sqrt[3]{18}$

B. 6

C. 9

D. 18

E. 27

2. For all positive m and n, $m^{\frac{4}{3}}n^{\frac{1}{4}}$ can be written in which of the following radical forms?

A. $\sqrt[12]{m^4n}$

B. $\sqrt[12]{m^4n^3}$

C. $\sqrt[12]{m^4n^4}$

D. $m\sqrt[12]{m^4n^3}$

E. $mn\sqrt[12]{m^7n^7}$

3. For all positive x, which of the following expressions is equivalent to $\sqrt[6]{x^5}(\sqrt[3]{x^5})$?

A. $x^{\frac{9}{10}}$

B. x

C. $x^{\frac{10}{9}}$

D. $x^{\frac{9}{5}}$

E. $x^{\frac{5}{2}}$

4. The digit in the ones place of 3^{74} is 9. What is the digit in the ones place of 3^{72} ?

A. 1
B. 3
C. 6
D. 7
E. 9

5. If $s > 0$ and $t > 0$, $\sqrt{\frac{s}{t}} + \sqrt{\frac{t}{s}}$ is equivalent to which of the following?

A. 1

B. $\frac{s+t}{st}$

C. $2\sqrt{ts}$

D. $\frac{2\sqrt{ts}}{t+s}$

E. $\frac{s+t}{\sqrt{st}}$

6. For all $y > 0$, which of the following expressions is NOT equivalent to $\sqrt[3]{\sqrt[2]{y^3}}$?

A. $\sqrt{y}$

B. $\sqrt[4]{y^2}$

C. $\sqrt{\sqrt[3]{y^3}}$

D. $y^{\frac{1}{3}}$

E. $y^{\frac{1}{2}}$

7. If c and x are positive rational integers such that $c^{3x} = 4$, then $c^{9x} = ?$

A. 8
B. 12
C. 16
D. 36
E. 64

8. For how many integers x is the equation $9^{3x+6} = 27^{2x+4}$ true?

A. 0
B. 1
C. 2
D. 3
E. An infinite number

9. The expression $\frac{x^{-3}y^{\frac{1}{2}}}{x^{\frac{1}{2}}y^{-1}}$, where $x > 1$ and $y > 1$, is equivalent to which of the following?

A. $\frac{(\sqrt[3]{x})(y\sqrt{y})}{\sqrt{x}}$

B. $\frac{y\sqrt{y}}{x^3\sqrt{x}}$

C. $\frac{x^3\sqrt{x}}{y\sqrt{y}}$

D. $\frac{(\sqrt[3]{x})(\sqrt{y})}{y\sqrt{x}}$

E. $\frac{\sqrt[2]{x^7}}{\sqrt[2]{y^3}}$

10. Whenever l and m are positive integers such that $(\sqrt[3]{5})^l = 125^m$, what is the value of $\frac{l}{m}$?

A. $\frac{1}{9}$

B. $\frac{1}{3}$

C. 1

D. 3

E. 9

11. $(\sqrt[m]{2})3^{\frac{2}{m}}$

If m is a positive integer, which of the following is the equivalent to the expression above?

A. $2^{\frac{1}{m}}$

B. $6^{\frac{1}{m}}$

C. $\sqrt[m]{9}$

D. $\sqrt[m]{18}$

E. $\sqrt[m]{216}$

12. If $\frac{\sqrt{y^5}}{\sqrt[3]{y^2}} = y^{\frac{j}{k}}$ for all positive values of y, what is the value of $\frac{j}{k}$?

A. $\frac{3}{13}$

B. 1

C. $\frac{11}{6}$

D. $\frac{15}{4}$

E. $\frac{13}{3}$

13. If $\frac{x^{c^2}}{x^{d^2}} = x^{20}$, $x > 1$, and $c - d = 5$, what is the value of $c + d$?

A. 4

B. 10

C. 15

D. 20

E. 25

14. If $4y - 2x = 14$, what is the value of $\frac{16^y}{4^x}$?

A. 2^7

B. 2^{14}

C. 4

D. 4^{14}

E. The value cannot be determined from the information given.

15. Let a and b be nonzero real numbers such that $3^{b+1} = 3a$. Which of the following is an expression for 3^{b+3} in terms of a?

A. $\frac{1}{9a^3}$

B. $\frac{1}{6a}$

C. a^3

D. $6a^2$

E. 27a