7.2B *Definition of Rational Exponents*

#1 – 8: Match each expression with its simplified form.

1. $25^{1/2}$ __H__ 2. $81^{1/2}$ __B__ 3. $8^{1/3}$ __D__ 4. $4^{3/2}$ __E__

5. $27^{-2/3}$ __G__ 6. $\left(\dfrac{1}{9}\right)^{1/2}$ __A__ 7. $\left(\dfrac{1}{9}\right)^{-1/2}$ __F__ 8. $\left(25a^8\right)^{1/4}$ __C__

[A] $\dfrac{1}{3}$ [B] 9   [C] $a^2\sqrt{5}$ [D] 2   [E] 8   [F] 3   [G] $\dfrac{1}{9}$ [H] 5

9. Which expression is equal to $9^{1/3}$?

[A] 3   [B] $\sqrt{9^3}$ [C] $\sqrt[3]{9}$ ⟲   [D] $\dfrac{1}{9^3}$

10. Which expression is equal to $\left(a^2-9\right)^{-2/3}$?

[A] $\sqrt[3]{\left(a^2-9\right)^2}$ [B] $\dfrac{1}{\sqrt[3]{\left(a^2-9\right)^2}}$ ⟲   [C] $\dfrac{1}{\sqrt{\left(a^2-9\right)^3}}$ [D] $\sqrt{\left(a^2-9\right)^3}$

#11 – 17: A student rewrote each expression in radical notation. Are her answers correct? If no, explain what she did wrong and how to do the problem correctly.

11. $17^{1/2}=\dfrac{1}{\sqrt{17}}$

She did $17^{-\frac{1}{2}}$;
A positive fraction exponent
$\boxed{\sqrt{17}}$
is just a radical.

12. $11^{1/4}=\sqrt[4]{11}$

⟲ CORRECT ⟲

13. $7^{3/4}=\left(\sqrt[4]{7}\right)^3$

⟲ Correct ⟲

14. $\left(5b\right)^{1/5}=\sqrt[5]{b}$

She missed 5's should
be a radical on the 5,
similar to b's which she did
Correctly. Using power on a
product yields $\boxed{\sqrt[5]{5b}}$

15. $\left(3bc\right)^{2/5}=\sqrt[5]{\left(3bc\right)^2}$

⟲ Correct ⟲

16. $\left(3fg^3\right)^{1/2}=\sqrt{3fg^3}$

1st step is correct but
the radical can be simplified.
$\sqrt{g^3}=\sqrt{g^2\cdot g}=g\sqrt{g}$, so $\sqrt{3fg^3}\Rightarrow \boxed{g\sqrt{3fg}}$

17. $7^{3/4}=\left(\sqrt[4]{7}\right)^3$
$4^{\frac{4}{5}}=\left(\sqrt[4]{4}\right)^5$

The index of the
radical is the denominator
of the fractional exponent.
So $4^{\frac{4}{5}}=\left(\sqrt[5]{4}\right)^4$

18. Which expression is equal to $\sqrt[7]{\dfrac{3}{4}r^8s}$?

[A] $\left(\dfrac{3}{4}r^8s\right)^{1/2}$ [B] $\left(\dfrac{3}{4}r^8s\right)^7$ [C] $\dfrac{3}{4}r^8s^{1/7}$ [D] $\left(\dfrac{3}{4}r^8s\right)^{1/7}$

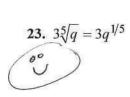19. Which expression is equal to $\sqrt{13^5}$?

[A] $13^{1/5}$ [B] $13^{2/5}$ [C] $13^{5/2}$ [D] $13^{5/1}$
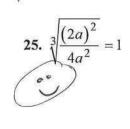
7.2B Definition of Rational Exponents

#20 – 25: Erich turned in this assignment. Correct his work. If his answer is correct, place a smiley face next to the problem. If his answer is incorrect, cross out his answer, write the correct answer and explain why his answer is incorrect.

20. $\sqrt[3]{16} = 16^{1/3}$ ☺

21. $\sqrt[4]{5d} = 5d^{1/4}$ $(5d)^{1/4}$
The radicand is $5d$, not d.

22. $\sqrt[6]{36fg} = 6f^{1/6}g^{1/6} = 36^{1/6}f^{1/6}g^{1/6}$
$36^{1/6} \neq 6$, and cannot be simplified.

23. $3\sqrt[5]{q} = 3q^{1/5}$ ☺

24. $\sqrt[5]{b^2 + c^2} = b^{2/5} + c^{2/5}$ $(b^2+c^2)^{1/5}$
There is NO Power on a Sum exponent property.
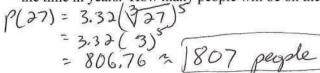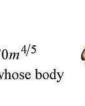
25. $\sqrt[3]{\dfrac{(2a)^2}{4a^2}} = 1$ ☺

#26 – 33: Simplify each expression if possible. There should not be any negative exponents in your final answer. Show your process for doing this (i.e. Do **NOT** simply enter this into a calculator.)

26. $9^{-1/2} = \dfrac{1}{9^{1/2}} = \dfrac{1}{\sqrt{9}} = \dfrac{1}{3}$

27. $125^{1/3}$
$\sqrt[3]{125} = 5$

28. $16^{-5/2}$
$\dfrac{1}{16^{5/2}} = \dfrac{1}{(\sqrt{16})^5} = \dfrac{1}{4^5} = \dfrac{1}{1024}$

29. $\left(\dfrac{16}{49}\right)^{1/2} = \sqrt{\dfrac{16}{49}} = \dfrac{\sqrt{16}}{\sqrt{49}} = \dfrac{4}{7}$

30. $\left(\dfrac{25}{49}\right)^{-3/2}$
$\left(\dfrac{25}{49}\right)^{3/2} = \left(\sqrt{\dfrac{25}{49}}\right)^3 = \left(\dfrac{5}{7}\right)^3 = \dfrac{125}{343} = \dfrac{343}{125}$

31. $(343d^3)^{1/3} =$
$\sqrt[3]{343d^3} = 7d$

32. $\left(\dfrac{16}{81g^4}\right)^{3/4} = \dfrac{16^{3/4}}{(81g^4)^{3/4}} = \dfrac{(\sqrt[4]{16})^3}{81^{3/4}g^3} = \dfrac{2^3}{(\sqrt[4]{81})^3 \cdot g^3} = \dfrac{8}{27g^3}$

33. $(64b^6)^{-2/3} = \dfrac{1}{(64b^6)^{2/3}} = \dfrac{1}{64^{2/3}b^4} = \dfrac{1}{(\sqrt[3]{64})^2 \cdot b^4} = \dfrac{1}{4^2 b^4} = \dfrac{1}{16b^4}$

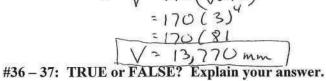34. The population of the Island of Sodor can be modeled by the equation $P(t) = 3.32t^{5/3}$. Where P represents the population in millions and t represents the time in years. How many people will be on the island after 27 years?

$P(27) = 3.32\left(\sqrt[3]{27}\right)^5$
$= 3.32(3)^5$
$= 806.76 \approx \boxed{807 \text{ people}}$

35. For mammals, the lung volume V (in millimeters) can be modeled by $V = 170m^{4/5}$ where m is the body mass (in kilograms). Find the lung volume of a camel whose body mass is 243kg.

$V = 170\left(\sqrt[5]{243}\right)^4$
$= 170(3)^4$
$= 170(81)$
$\boxed{V = 13,770 \text{ mm}}$

#36 – 37: TRUE or FALSE? Explain your answer.

36. $-36^{1/2} = -6$ TRUE
By order of operations, powers are done before multiplying by -1. So $-\sqrt{36} = \boxed{-6}$

35. $(-16)^{1/4} = 2$ FALSE
$\sqrt[4]{(-16)}$ is NOT REAL
$2^4 \neq -16$ or $2^4 = 16$
$(-2)^4 \neq 16$ or $(-2)^4 = 16$

Section 7.2B