Name:_____ Date:_____

HW#_____
UNIT 8 REVIEW

Simplify each expression using positive exponents only.

1. $3x^4 \cdot -2x^3$ $-6x^7$

2. $\frac{2x^7}{(3x)^3}$ $\frac{2x^7}{(3)^3(x)^3} \rightarrow \frac{2x^7}{27x^3}$ $\frac{2x^4}{27}$

3. $\frac{2}{(x^3)^{-2}}$ $\frac{2}{x^{-6}} \rightarrow 2x^6$

4. $\frac{x^{-4}x^5}{x^7}$ $\frac{x^1}{x^7} \rightarrow x^{-6} \rightarrow \frac{1}{x^6}$

5. $\frac{6x^{-7}}{x^{-4}}$ $6x^{-3} \rightarrow \frac{6}{x^3}$ $-7--4$

6. $(x^3)^n \cdot x^4$ $x^{3n} \cdot x^4 \rightarrow x^{3n+4}$

7. a. Use the properties of exponents to simplify the expression.
   b. Then evaluate the expression for the given value of x.

$4x^4 \cdot \frac{6}{4}x^{-2}$; $x = 3$

a) $(4 \cdot \frac{6}{4})(x^4 \cdot x^{-2})$ $6x^2$

b) $6(3)^2 \rightarrow 6(9)$ 54

8. Rewrite as a radical expression & simplify the radical if possible.

a) $9^{\frac{3}{2}}$ power / root

$\sqrt[2]{9^3}$ or $(\sqrt[2]{9})^3$

$(3)^3 \rightarrow 27$

b) $y^{\frac{2}{3}} \cdot y^{\frac{5}{3}}$

$y^{\frac{2}{3}+\frac{5}{3}} \rightarrow y^{\frac{7}{3}}$

$\sqrt[3]{y^7}$

c) $y^{\frac{2}{3}} \cdot y^{-\frac{7}{3}}$

$y^{\frac{2}{3}+\frac{-7}{3}} \rightarrow y^{\frac{-5}{3}}$

$\frac{1}{y^{5/3}} \rightarrow \frac{1}{(\sqrt[3]{y})^5}$

9. Rewrite with a fraction exponent & simplify if possible:

a) $\sqrt[3]{x^4}$ $x^{\frac{4}{3}}$

b) $\sqrt[3]{x^2y^4}$ $x^{\frac{2}{3}}y^{\frac{4}{3}}$

c) $(\sqrt[2]{me})^5$ $(me)^{\frac{5}{2}}$ $m^{\frac{5}{2}}e^{\frac{5}{2}}$

10. When $b > 0$ and d is a positive integer, the expression $(3b)^{\frac{2}{d}}$ is equivalent to

$\sqrt[d]{(3b)^2}$ $\quad (3b)^{\frac{2}{d}}$

1) $\dfrac{1}{\left(\sqrt[d]{3b}\right)^2}$ 2) $\left(\sqrt{3b}\right)^d$ 3) $\dfrac{1}{\sqrt{3b^d}}$ 4) $\left(\sqrt[d]{3b}\right)^2$

11. Use the properties of rational exponents to determine the value of y for the equation:

$$\frac{x^{\frac{8}{3}}}{x^{\frac{4}{3}}} = x^y \qquad \frac{\sqrt[3]{x^8}}{\left(x^4\right)^{\frac{1}{3}}} = x^y,\ x > 1$$

multiply

$$x^{\frac{4}{3}} = x^y$$

$$y = \frac{4}{3}$$

For # 12 – 15, solve for x.

12. $\dfrac{2x^{\frac{4}{3}}}{2} = \dfrac{162}{2}$

$x^{\frac{4}{3}} = 81$

$\left(x^{\frac{4}{3}}\right)^{\frac{3}{4}} = (81)^{\frac{3}{4}}$

$x = 27$ ✓

13. $(x+2)^{\frac{2}{3}} - 1 = 3$

$+1 \quad +1$

$(x+2)^{2/3} = 4$

$\left((x+2)^{\frac{2}{3}}\right)^{\frac{3}{2}} = (4)^{\frac{3}{2}}$

$x + 2 = 8$

$x = 6$ ✓

14. $4x^{-\frac{1}{4}} + 6 = 8$

$-6 \quad -6$

$\dfrac{4x^{-\frac{1}{4}}}{4} = \dfrac{2}{4}$

$x^{-\frac{1}{4}} = \dfrac{1}{2}$

$\left(x^{-\frac{1}{4}}\right)^{-4} = \left(\dfrac{1}{2}\right)^{-4}$

$x = 16$ ✓

15. $\dfrac{10x^{-\frac{1}{2}}}{10} = \dfrac{15}{10}$

$x^{-\frac{1}{2}} = 1.5$

$\left(x^{-\frac{1}{2}}\right)^{-2} = (1.5)^{-2}$

$x = \dfrac{4}{9}$ ✓

16. Grace invests $5,000 at an annual rate of 4% compounded *continuously*. Determine, to the nearest dollar, the amount of money she will have after 7 years.

4% → .04

$A = Pe^{rt}$

$A = 5000e^{(.04)(7)}$

$A = 6615.649062$

$A = \$6,616$

17. The enrollment at Calhoun was 1,621 in 2016 and is decreasing at an annual rate of .2%. If this rate continues, what is the projected enrollment at Calhoun in 2020?

≈ 2%

$A = P(1-r)^t$

$A = 1621(1-.002)^4$

$A = 1608.070852$ → cannot have a decimal of a person: always round down

$\boxed{A = 1{,}608 \text{ people}}$

18. If you invest $1,000 at 6% interest, compounded *quarterly*, how much *profit* will you make at the end of 20 years?

$A = P\left(1+\frac{r}{n}\right)^{nt}$

$A = 1000\left(1+\frac{.06}{4}\right)^{4(20)}$

$A = 3290.662787$

-1000

$\boxed{\$2290.66}$ profit

19. G-money likes to invest his money in mutual funds because it's a safe bet. The value, $p(x)$, of his mutual portfolio can be modeled with the function $p(x) = 1{,}000(1.04)^t$, where t is the number of years since he made his investment. Which statement describes the rate of change of the value of his portfolio?

1) It decreases 4% per year.
2) It decreases 40% per year.
3) It increases 4% per year.
4) It increases 40% per year.

$1 + r = 1.04$

$-1 \quad -1$

$r = .04$

4%

20. G-Money's sister, G-Spice, also likes to invest her money. The value, $p(x)$, of her portfolio can be modeled with the function $p(x) = 1{,}000(.98)^t$, where t is the number of years since she made her investment. Which statement describes the rate of change of the value of her portfolio?

1) It decreases 2% per year.
2) It decreases 98% per year.
3) It increases 2% per year.
4) It increases 98% per year.

$1 - r = .98$

$-1 \quad -1$

$-r = -.02$

$r = .02$

2%

For # 21 – 24, solve for x.

21. $5^{x-1} = 125$

$5^{x-1} = 5^3$

$x - 1 = 3$

$\boxed{x = 4}$

22. $27^x = 9^{x+2}$

$(3^3)^x = (3^2)^{x+2}$

$3x = 2x + 4$

$\boxed{x = 4}$

23. $3^{x^2-3} = 9^x$

$3^{x^2-3} = (3^2)^x$

$x^2 - 3 = 2x$

$x^2 - 2x - 3 = 0$

$(x - 3)(x + 1) = 0$

$\boxed{x = 3}$ | $\boxed{x = -1}$

24. $\left(\frac{1}{3}\right)^{1-x} = 9^x$

$(3^{-1})^{1-x} = (3^2)^x$

$-1 + x = 2x$

$\boxed{-1 = x}$

25. Which function shown below has a greater average rate of change on the interval $[-3,3]$? Justify your answer.

x	f(x)
−4	0.3125
−3	0.625
−2	1.25
−1	2.5
0	5
1	10
2	20
3	40
4	80
5	160
6	320

$g(x) = 4x^3 - 5x^2 + 3$

x	y
−3	−150
−2	
−1	
0	
1	
2	
3	66

$g(x) = \frac{66 - -150}{3 - -3}$ $f(x) = \frac{40 - .625}{3 - -3}$

$= \frac{216}{6}$ $= \frac{39.375}{6}$

$\boxed{g(x) = 36}$ | $\boxed{f(x) = 6.5625}$

g(x) has a greater rate of change

26 The distance needed to stop a car after applying the brakes varies directly with the square of the car's speed. The table below shows stopping distances for various speeds.

X	**Speed** (mph)	10	20	30	40	50	60	70
y	**Distance** (ft)	6.25	25	56.25	100	156.25	225	306.25

Determine the average rate of change in braking distance, in ft/mph, between one car traveling at 50 mph and one traveling at 70 mph. Explain what this rate of change means as it relates to braking distance.

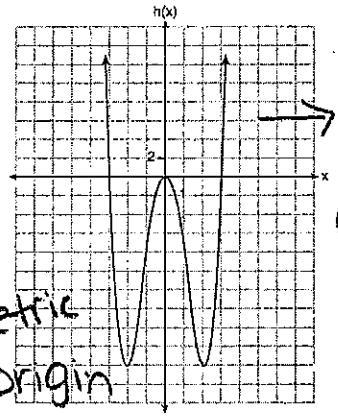
$$\frac{\Delta y}{\Delta x} = \frac{306.25 - 156.25}{70 - 50} = \frac{150}{20} = 7.5 \text{ ft/mph}$$

For every 1 mile per hour you drive, it takes 7.5 ft to stop.

27 Functions f, g, and h are given below and to the right.

$f(x) = \sin(2x)$

$g(x) = f(x) + 1$



symmetric to y-axis (even function)

Which statement is true about functions f, g, and h?

1) $f(x)$ and $g(x)$ are odd, $h(x)$ is even.

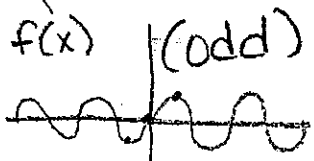
2) $f(x)$ and $g(x)$ are even, $h(x)$ is odd.

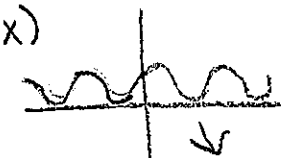
3) $f(x)$ is odd, $g(x)$ is neither, $h(x)$ is even.

4) $f(x)$ is even, $g(x)$ is neither, $h(x)$ is odd.

symmetric to origin

f(x) (odd) g(x)





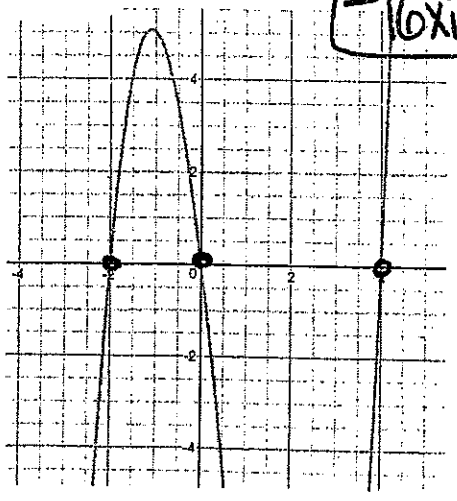
neither

28 Simplify $xi(i+3i)^2$, where i is the imaginary unit. (Hint: use PEMDAS)

$xi(4i)^2 \rightarrow xi(4i)(4i) \rightarrow 16xi^3 \rightarrow 16x(-i)$

$-16xi$

29. For the graph of $f(x)$ shown, write an equation for $f(x)$ in polynomial form.



$x = 0 \quad x = -2 \quad x = 4$

$x(x+2)(x-4) = f(x)$