## Math Review

## Exponents -Basic Definitions

For any real number base $x$, we define powers of $x: x^{0}=1, x^{1}=x, x^{2}=x \cdot x, x^{3}=x \cdot x \cdot x$, etc.
(The exception is $0^{0}$, which is considered indeterminate.) Powers are also called exponents.
Example: $5^{0}=1,(-11.2)^{1}=-11.2,(8.6)^{2}=8.6 \cdot 8.6=73.96,10^{3}=10 \cdot 10 \cdot 10=1000$ Also, we can define fractional exponents in terms of roots, such as $x^{1 / 2}=\sqrt{x}$, the square root of $x$.

Similarly, $x^{1 / 3}=\sqrt[3]{x}$, the cube root of $x, x^{2 / 3}=\sqrt[3]{(x)^{2}}$, etc. In general, we have $x^{m / n}=\sqrt[n]{(x)^{m}}$
Example: $64^{1 / 2}=\sqrt{64}=8,64^{1 / 3}=\sqrt[3]{64}=4,64^{3 / 2}=\sqrt{(64)^{3}}=512,64^{2 / 3}=\sqrt[3]{(64)^{2}}=4^{2}=16$
Finally, we define negative exponents: $\boldsymbol{x}^{-r}=\frac{1}{\boldsymbol{x}^{r}}$. Thus, $x^{-1}=\frac{1}{x}, x^{-2}=\frac{1}{x^{2}}, x^{-1 / 2}=\frac{1}{\sqrt{x}}$, etc.
Example: $10^{-1}=\frac{1}{10}=0.1,7^{-2}=\frac{1}{7^{2}}=\frac{1}{49^{\prime}}, 36^{-1 / 2}=\frac{1}{\sqrt{36}}=\frac{1}{6}, 9^{-5 / 2}=\frac{1}{\sqrt{9^{5}}}=\frac{1}{243}$

## Properties of Exponents

1. $x^{a} \cdot x^{b}=x^{a+b}$
2. $\frac{x^{a}}{x^{b}}=x^{a-b}$
3. $\left(x^{a}\right)^{b}=x^{a b}$

Simplify:

1. $x^{2} \cdot x^{3}=$
2. $x^{1 / 2} \cdot x^{1 / 3}=$
3. $\frac{x^{3}}{x^{5}}=$
4. $\left(x^{-1 / 2}\right)^{7}=$
5. $x^{3} \cdot x^{-1 / 2}=$

Simplify:

$$
\text { 4. } \frac{x^{5}}{x^{3}}=\quad \text { 7. }\left(x^{3}\right)^{2}=
$$

Simplify:
6. $\frac{x^{3}}{x^{\frac{1}{2}}}=$
9. $\left(x^{2 / 3}\right)^{5 / 7}=$

Functions and their graphs:


Independent Variable Dependent Variable

1. Linear: $y=m x+b$
2. Polynomial: $y=a x^{n}+b x^{n-1}+\cdots+c x$
3. Power: $y=a x^{n}$
4. Exponential: $y=a b^{x}$

## Match a function:

1. Linear
2. Polynomial
3. Exponential
4. Power

A. $Y=2 x^{2}+3 x-8$
B. $Y=4^{x}$
C. $Y=2 x+3$
D. $Y=x^{-2}$
E. $Y=3 x-1.5$
F. $Y=x^{2}$


III


IV

## Significant Figures

- A significant figure is a reliably known digit
- All non-zero digits are significant
- Zeroes that only locate the decimal point are NOT significant
- Scientific notion removes the possibility of misinterpretation

Express in scientific notation keeping 3 sig.figs:
$38,034=$
$34,798,000=$
$0.0702=$
$0.285=$
$0.002=$
$300,000,876,000=$

## Prefixes

- Basic Unit has no prefix ( $\mathrm{g}, \mathrm{s}, \mathrm{m}, \mathrm{L}$ )
- Prefixes are conversion factors to a basic unit
- Prefixes correspond to powers of 10
- Each prefix has a specific name
- Each prefix has a specific abbreviation

| $10^{-12}$ | pico | P | pF | pico-Farada |
| :---: | :---: | :---: | :---: | :---: |
| $10^{-9}$ | nano | n | nm | nano-Meter |
| $10^{-6}$ | micro | $\mu$ | $\mu \mathrm{C}$ | micro-Coulomb |
| $10^{-3}$ | milli | m | mA | milli-Amper |
| $10^{3}$ | kilo | k | kg | kilo-gram |
| $10^{6}$ | mega | M | MV | mega-Volt |
| $10^{9}$ | giga | G | GHz | giga-Hertz |

## Conversions

- When units are not consistent, you may need to convert to appropriate ones
- Need to know a conversion factor!
- Units can be treated like algebraic quantities that can "cancel" each other
- Example:

$$
15.0 \mathrm{in} \times \frac{2.54 \mathrm{~cm}}{1 \mathrm{in}}=38.1 \mathrm{~cm}
$$

300 MHz to Hz

520 nm to m
0.876 mg to g

834 km to cm
4.h to min
0. $20 s$ to hours
$563 \mu \mathrm{~m}$ to cm
$72 \mathrm{~km} / \mathrm{h}$ to $\mathrm{m} / \mathrm{s}$

