Midterm Review: Exponents

Parts of a power

$-5x^2$ — coefficient: -5; base: x; exponent: 2

5^2 — exponent: 2

$3x^4y^2$ — coefficient: 3; bases: x, y; exponents: 4, 2

Expanded Form and Evaluated Powers

Power	Expanded Form	Evaluated
5^2	(5)(5)	25
-3^4	–(3)(3)(3)(3)	–81
$(-3)^4$	(–3)(–3)(–3)(–3)	81
$5x^4$	5(x)(x)(x)(x)	////////////////////

Like and Unlike Terms

For terms to be **LIKE** they must have the **same base** and the **same exponent** (the coefficient can be anything)

Examples:

Like terms: $5x^2$, $\frac{1}{2}x^2$, $-x^2$ and πx^2 x^2y, yx^2 and $4x^2y$

Unlike terms: x and x^2 $4x^2$ and $4x^2y$ $5x^2y$ and $5xy^2$

Substituting

Replace the letters with the **KNOWN values** for the letters. Then, evaluate using correct order of operations.

Remember: put brackets around the number you're substituting.

$3a^2 - 5b + a$ when $a = -4$ and $b = -1$

$= 3(-4)^2 - 5(-1) + (-4)$

$= 3(16) + 5 - 4$

$= 48 + 5 - 4$

$= 49$

Remember:
Put brackets around the number you're substituting.

Exponent Laws:

Exponent laws only apply for exponents with the **SAME bases**

Multiplication Rule

ADD the **exponents**, **MULTIPLY** the **coefficients**, keep the **bases** the **SAME**

$(4x^2)(6x^3) = 24x^5$	$(x^2)(x^3) = x^5$
$(4^2)(4^3) = 4^5$	$(3x^4y)(5x^2y^6) = 15x^6y^7$

Division Rule

SUBTRACT the **exponents**, **DIVIDE** the **coefficients**, keep the **bases** the **SAME**

$\frac{12x^7}{3x^2} = 4x^5$	$\frac{x^7}{x^2} = x^5$
$\frac{4^7}{4^2} = 4^5$	$\frac{15x^7y^5}{5x\,y^4} = 3x^6\,y$

Power of a Power Rule

MULTIPLY the **exponents**, raise to the **POWER** for the **coefficients**, keep the **bases** the **SAME**

$(4x^2)^3 = 64x^6$	$(x^2)^3 = x^6$
$(4^2)^3 = 4^6$	$(3x^4y)^2 = 9x^8y^2$

Negative Exponents

To make the exponent positive, take the **reciprocal**, then simplify

$x^{-5} = \dfrac{1}{x^{5}}$	$3x^{-5}\,y^{2} = \dfrac{3y^{2}}{x^{5}}$
$(2x^{3}y^{4})^{-2} = \dfrac{1}{(2x^{3}y^{4})^{2}}$	$\dfrac{15x^{7}y^{5}}{5x\,y^{4}} = 3x^{6}\,y$

Zero Exponents

Anything to the power of 0 **equals 1**

$4x^{0} = 4(1) = 4$	$(4xy^{2})^{0} = 1$
$5x^{0}y^{4} = 5(1)y^{4} = 5y^{4}$	$\dfrac{15x^{7}y^{5}}{(5xy^{4})^{0}} = \dfrac{15x^{7}y^{5}}{1} = 15x^{7}y^{5}$

Combining the Exponent Laws

Usually do brackets, then apply the ❶ power of a power rule, ❷ multiplication rule, and then the ❸ division rule – always follow proper order of operations. Use the negative exponents rule to make exponents positive.

$\dfrac{[(4^{2})(4^{5})]^{3}(4)}{(4^{6})(4^{3})}$ $= \dfrac{(4^{7})^{3}(4)}{4^{9}}$ $= \dfrac{(4^{21})(4^{1})}{4^{9}}$ $= 4^{13}$	$\dfrac{[(5xy)(3x^{2}y^{4})]^{2}}{(9x^{2}y^{7})(x^{0}y^{9})}$ $= \dfrac{(15x^{3}y^{5})^{2}}{9x^{2}y^{16}}$ $= \dfrac{225x^{6}y^{10}}{9x^{2}y^{16}}$ $= 25x^{4}y^{-6}$ $= \dfrac{25x^{4}}{y^{6}}$

Midterm Review: Polynomials

Simplifying

Add/subtract like terms only. You may collect like terms first (move the terms around so that the like ones are together).

Example #1: $4x - 5 + 3x - 1$

Collect like terms: $= 4x + 3x - 5 - 1$

Simplify: $= 7x - 6$

> **Remember:** The sign in front of the term belongs to that term.

Example #2: $-x^2 - 12x + 3y - 6xy - 3 - 5x^2 + 2xy$

Collect like terms: $= -x^2 - 5x^2 - 6xy + 2xy - 12x + 3y - 3$

Simplify: $= -6x^2 - 4xy - 12x + 3y - 3$

Distributive Property: Expanding

Multiply the number outside of the brackets **to ALL of the terms in the brackets**.

$-3(x^2 - 12x + 5)$

$= -3x^2 + 36x - 15$

You may need to apply the exponent laws:

$-3x(x^2 - 12x + 5)$

$= -3x^3 + 36x^2 - 15x$

Expanding and Simplifying

Multiply the number outside of the brackets **to ALL of the terms in the brackets**. Then, simplify by adding and subtracting any like terms.

$3(4x + 7) + 5 - (4x - 9)$

$= 12x + 21 + 5 - 4x + 36$

$= 12x - 4x + 21 + 5 + 36$

$= 8x + 62$

Midterm Review: Solving Equations

Solving for an unknown

Simplify as much as you can first.

Using **opposite** operations, **isolate the variable** (Get *x* by itself).

> **Remember:**
> What you do to one side of the equation, you must do to the other.

$$4x + 3 = -x - 7$$

$$4x + x + 3 = -x + x - 7$$

$$5x + 3 = -7$$

$$5x + 3 - 3 = -7 - 3$$

$$5x = -10$$

$$\frac{5x}{5} = \frac{-10}{5}$$

$$\boxed{x = -2}$$

> **Tip:**
> Keep equal signs lined up to stay organized

Expand first (distributive property) if needed, then continue solving.

$$3(-b + 7) - 5 = 9b + 12 - (4b + 8)$$ ←**Distribute (expand)**

$$-3b + 21 - 5 = 9b + 12 - 4b - 8$$ ←**Simplify by adding/subtracting like terms**

$$-3b + 16 = 5b + 4$$

$$-3b - 5b + 16 = 5b - 5b + 4$$ ←**Decide which side you want your variable on**

$$-8b + 16 = 4$$

$$-8b + 16 - 16 = 4 - 16$$ ←**Move numbers to the side opposite your variable**

$$-8b = -12$$

$$\frac{-8b}{-8} = \frac{-10}{-8}$$

$$\boxed{b = \frac{5}{4} \text{ or } 1.25}$$

> **Tip:**
> If the question doesn't specify, decimal answers can be rounded to two decimal points, or left as fractions in lowest terms

Checking your solution

Without solving this equation, determine whether the correct solution is **x = –2** or **x = 2**

2(4x – 5) + 3 + x = 12 – x + 1

Checking x = –2	*Checking x = 2*
LS | RS **2(4x – 5) + 3 + x = 12 – x + 1** **2[4(–2) – 5] + 3 + (–2) | 12 – (–2) + 1** **2(–8 – 5) + 3 –2 | 12 + 2 + 1** **2(–13) + 3 –2 | 15** **–26 + 3 –2 | 15** **–25 | 15** **LS ≠ RS** ✘	LS | RS **2(4x – 5) + 3 + x = 12 – x + 1** **2[4(2) – 5] + 3 + (2) | 12 – (2) + 1** **2(8 – 5) + 3 + 2 | 12 – 2 + 1** **2(3) + 3 + 2 | 11** **6 + 3 + 2 | 11** **11 | 11** **LS = RS** ✔
Therefore, the correct solution is x = 2	

Rearranging Formulas

Isolate the required variable using opposite operations, just like when solving equations.

Rearrange to isolate "**t**"	Rearrange to isolate "**x**"
$P = \frac{E}{t}$ $t(P) = \left(\frac{E}{t}\right)t$ $tP = E$ $\frac{tP}{P} = \frac{E}{P}$ $t = \frac{E}{P}$	$y = 3x^2 - 5$ $y + 5 = 3x^2 - 5 + 5$ $y + 5 = 3x^2$ $\frac{y+5}{3} = \frac{3x^2}{3}$ $\frac{y+5}{3} = x^2$ $\sqrt{\frac{y+5}{3}} = \sqrt{x^2}$ $\sqrt{\frac{y+5}{3}} = x$

<u>Solving for an unknown with a fraction</u>

Option A: Clear fractions one at a time

Short way	Long way
$$\frac{3x-2}{4}+7=\frac{-x+4}{5}$$ $$4\left(\frac{3x-2}{4}+7\right)=\left(\frac{-x+4}{5}\right)4$$ $$3x-2+28=\frac{-4x+16}{5}$$ $$5(3x+26)=\left(\frac{-4x+16}{5}\right)5$$ $$15x+130=-4x+16$$ $$15x+4x=16-130$$ $$19x=-114$$ $$\frac{19x}{19}=\frac{-114}{19}$$ $$x=\frac{-114}{19}$$	$$\frac{3x-2}{4}+7=\frac{-x+4}{5}$$ $$\frac{4}{1}\left(\frac{3x-2}{4}+7\right)=\left(\frac{-x+4}{5}\right)\frac{4}{1}$$ $$\frac{4(3x-2)}{1(4)}+4(7)=\frac{4(-x+4)}{1(5)}$$ $$\frac{3x-2}{1}+28=\frac{-4x+16}{5}$$ $$3x-2+28=\frac{-4x+16}{5}$$ $$5(3x+26)=\left(\frac{-4x+16}{5}\right)\frac{5}{1}$$ $$5(3x+26)=\frac{5(-4x+16)}{1(5)}$$ $$5(3x+26)=\frac{-4x+16}{1}$$ $$15x+130=-4x+16$$ $$15x+4x=16-130$$ $$19x=-114$$ $$\frac{19x}{19}=\frac{-114}{19}$$ $$x=\frac{-114}{19}$$

Option B: Clear all fractions at the same time (by finding the lowest common denominator)

Short way	Long way
$\frac{3x-2}{4}+7=\frac{-x+4}{5}$	$\frac{3x-2}{4}+7=\frac{-x+4}{5}$
$20\left(\frac{3x-2}{4}+7\right)=\left(\frac{-x+4}{5}\right)20$	$\frac{20}{1}\left(\frac{3x-2}{4}+7\right)=\left(\frac{-x+4}{5}\right)\frac{20}{1}$
$5(3x-2)+140=4(-x+4)$	$\frac{20(3x-2)}{1(4)}+140=\frac{20(-x+4)}{1(5)}$
$15x-10+140=-4x+16$	$\frac{20(3x-2)}{4}+140=\frac{20(-x+4)}{5}$
$15x+130=-4x+16$	$5(3x-2)+140=4(-x+4)$
$15x+4x=16-130$	$15x-10+140=-4x+16$
$19x=-114$	$15x+130=-4x+16$
$\frac{19x}{19}=\frac{-114}{19}$	$15x+4x=16-130$
$x=\frac{-114}{19}$	$19x=-114$
	$\frac{19x}{19}=\frac{-114}{19}$
	$x=\frac{-114}{19}$