

This handout will provide a quick introduction into algebraic expressions.

Definition: A **numerical expression** is an expression that combines numbers and operations.

For example, $3 \cdot 5^2$ is a numerical expression. So are $-\frac{2}{3+1}$ and $5^2 - 2^2$ and $-|-5|$. We can **evaluate** numerical expressions by correctly applying the order of operations agreement. It is important that we clearly understand notation.

Example 1: Evaluate each of the given numerical expressions.

a) $3 \cdot 5^2$ b) $-\frac{2}{3+1}$ c) $3^2 + 2^2$ d) $(3+2)^2$ e) -3^2 f) $(-3)^2$ g) $-|-5|$

Solution: a) Between exponentiation and multiplication, we first perform the exponentiation. $3 \cdot 5^2 = 3 \cdot 25 = \boxed{75}$

b) The addition in the denominator must be performed before we divide. (Why?) $-\frac{2}{3+1} = -\frac{2}{4} = \boxed{-\frac{1}{2}}$

c) $3^2 + 2^2 = 9 + 4 = \boxed{13}$

d) $(3+2)^2 = 5^2 = \boxed{25}$

Note: The error of confusing $3^2 + 2^2$ with $(3+2)^2$ is called the "Freshman's Dream Error".

e) $-3^2 = \boxed{-9}$

f) $(-3)^2 = \boxed{9}$

Note: In looking at -3^2 and $(-3)^2$, we can interpret the minus sign in front of 3 as 'the opposite of'.

That is the same as multiplication by -1 . Now we can apply order of operations, and exponentiation comes before multiplication.

$$-3^2 = -1 \cdot 3^2 = -1 \cdot 9 = -9 \quad \text{but} \quad (-3)^2 = (-3)(-3) = 9$$

In the case of -3^2 , we take the opposite of the square of three.

In the case of $(-3)^2$, we square the opposite of three.

g) $-|-5| = \boxed{-5}$ This is a perfect example that two minuses don't always make a plus. What happens here?

Definition: An **algebraic expression** is an expression that combines numbers, operations, and variables.

Variables always represent numbers, so they are subjects to the same rules as numbers. For example, $3x^2 - 1$ is an algebraic expression. So are $-x + 3$ and $2a - b$ and $5y + 3$. We can not automatically evaluate an algebraic expression because we often do not know the value of the variables. For example, the expression $3x^2 - 1$ has different values for different values of x .

Example 2: Evaluate the algebraic expression $3x^2 - 1$ given the values of x .

a) $x = 2$ b) $x = 0$ c) $x = -1$ d) $x = \frac{1}{2}$

Solution: a) If $x = 2$, then $3x^2 - 1 = 3 \cdot 2^2 - 1 = 3 \cdot 4 - 1 = 12 - 1 = \boxed{11}$

b) If $x = 0$, then $3x^2 - 1 = 3 \cdot 0^2 - 1 = 3 \cdot 0 - 1 = 0 - 1 = \boxed{-1}$

c) If $x = -1$, then $3x^2 - 1 = 3(-1)^2 - 1 = 3 \cdot 1 - 1 = 3 - 1 = \boxed{2}$

d) If $x = \frac{1}{2}$, then $3x^2 - 1 = 3\left(\frac{1}{2}\right)^2 - 1 = 3\left(\frac{1}{2} \cdot \frac{1}{2}\right) - 1 = 3 \cdot \frac{1}{4} - 1 = \frac{3}{4} - 1 = \frac{3}{4} - \frac{4}{4} = \boxed{-\frac{1}{4}}$

When we don't know the value of a variable, we often need to **simplify** algebraic expressions. Consider, for example, the algebraic expression $2x + 3x$. Clearly, we can simplify $2x + 3x$ and just write $5x$ instead. This is also called **combining like terms**.

Example 3: Simplify each of the following by combining like terms.

a) $3x - 2 - 10x + x + 7$ b) $3m - 2n - 4 - 8m + n + 1$ c) $ab - a + b$ d) $p + q + p - q$

Solution: a) $3x$, $-10x$, and x are like terms, and -2 and 7 are like terms.

To combine like terms, we add the numbers (sign included!) that are multiplying the variable(s). Such a number is called the **coefficient**. When combining like terms, we add the coefficients.

To combine $3x$, $-10x$, and x , we add the coefficients: $3x - 10x + x = (3 - 10 + 1)x = -6x$

Caution! It is a common mistake to misinterpret $3 - 10 + 1$ as $3 - 11$. Not so!

To combine -2 and 7 , we just add and so we get 5 . The entire process can be done mentally, so our computation will look like this:

$$3x - 2 - 10x + x + 7 = \boxed{-6x + 5}$$

b) $3m - 2n - 4 - 8m + n + 1 = 3m - 8m - 2n + n - 4 + 1 = \boxed{-5m - n - 3}$
 -3 , $-n$, and $-5m$ are unlike terms and so this expression can not be further simplified.

c) $\boxed{ab - a + b}$ since all three terms are unlike, so this expression can not be simplified.

d) $p + q + p - q = p + p + q - q = \boxed{2p}$

In the last example, as we simplified the expression, one of the variables disappeared. This special and often celebrated case of combining like terms is what we call **cancellation**.

To add two or more algebraic expressions, we drop parentheses and combine like terms.

Example 4: Add the algebraic expressions as indicated.

a) $(3a - 5b) + (2a - b)$ b) $(-m + 3n - 4) + (5m - n - 4)$ c) $(3y + 5) + (3y - 5)$ d) $\left(\frac{1}{2}x - \frac{2}{5}\right) + \left(\frac{3}{2}x + \frac{8}{5}\right)$

Solution: a) $(3a - 5b) + (2a - b) = 3a - 5b + 2a - b = 3a + 2a - 5b - b = \boxed{5a - 6b}$

b) $(-m + 3n - 4) + (5m - n - 4) = -m + 5m + 3n - n - 4 - 4 = \boxed{4m + 2n - 8}$

c) $(3y + 5) + (3y - 5) = 3y + 5 + 3y - 5 = 3y + 3y + 5 - 5 = \boxed{6y}$

d) $\left(\frac{1}{2}x - \frac{2}{5}\right) + \left(\frac{3}{2}x + \frac{8}{5}\right) = \frac{1}{2}x - \frac{2}{5} + \frac{3}{2}x + \frac{8}{5} = \frac{1}{2}x + \frac{3}{2}x + \frac{8}{5} - \frac{2}{5} = \left(\frac{1}{2} + \frac{3}{2}\right)x + \frac{8}{5} - \frac{2}{5} = \frac{4}{2}x + \frac{6}{5} = \boxed{2x + \frac{6}{5}}$

To multiply an algebraic expression by a number or a one-term expression, we apply the distributive law.

Example 5: Expand the products as indicated.

a) $3(5a - b + 1)$ b) $-1(-x^2 + 3x - 4)$ c) $5x(2a - x)$ d) $-ab(3a - 5b - 1)$ e) $\frac{2}{5}\left(\frac{3}{4}m - \frac{1}{2}\right)$

Solution: a) $3(5a - b + 1) = \boxed{15a - 3b + 3}$

b) $-1(-x + 3y - 4) = \boxed{x - 3y + 4}$

Note that multiplication by -1 means we change the sign in front of each term.

c) $5x(2a - 3) = 5x \cdot 2a - 5x \cdot 3 = 10ax - 15x = \boxed{10ax - 15x}$

$$d) -ab(3a - 5b - 1) = -ab \cdot 3a - ab(-5b) - ab(-1) = \boxed{-3a^2b + 5ab^2 + ab}$$

$$e) \frac{2}{5} \left(\frac{3}{4}m - \frac{1}{2} \right) = \frac{2}{5} \cdot \frac{3}{4}m + \frac{2}{5} \left(-\frac{1}{2} \right) = \boxed{\frac{3}{10}m - \frac{1}{5}}$$

To subtract an algebraic expression, we add the opposite.

Example 6: Perform the subtractions between algebraic expressions as indicated.

$$a) (3a - 5b) - (2a - b) \quad b) (3y + 5) - (3y - 5) \quad c) \left(\frac{1}{2}x - \frac{2}{5} \right) - \left(\frac{3}{2}x + \frac{8}{5} \right)$$

Solution: a) We apply one fundamental fact of algebra: *To subtract is to add the opposite*. The opposite is always obtained by multiplication by -1 . And this multiplication by -1 means we need to distribute -1 . We subtract the entire expression, not just its first term. Here is the argument, broken down to logical steps.

$$\begin{aligned} (3a - 5b) - (2a - b) &= && \text{to subtract is to add the opposite,} \\ (3a - 5b) + (-1)(2a - b) &= && \text{the opposite is obtained by multiplying by } -1 \text{ (careful with the distributive law)} \\ (3a - 5b) + (-2a + b) &= && \text{we add the algebraic expressions by dropping the parentheses} \\ 3a - 5b - 2a + b &= && \text{and combine like terms} \\ 3a - 2a - 5b + b &= && \boxed{a - 4b} \end{aligned}$$

But this is way too much writing. While the idea is the same, our computation usually looks like this:

$$(3a - 5b) - (2a - b) = (3a - 5b) + (-2a + b) = a - 4b$$

Careful! When computing on paper, we advise *not to subtract mentally*. To subtract is to add the opposite. Take the time of writing down the opposite, and then *add* mentally.

$$b) (3y + 5) - (3y - 5) = (3y + 5) + (-3y + 5) = \boxed{10}$$

$$c) \left(\frac{1}{2}x - \frac{2}{5} \right) - \left(\frac{3}{2}x + \frac{8}{5} \right) = \left(\frac{1}{2}x - \frac{2}{5} \right) + \left(-\frac{3}{2}x - \frac{8}{5} \right) = \left(\frac{1}{2} - \frac{3}{2} \right)x - \frac{2}{5} - \frac{8}{5} = \frac{-2}{2}x - \frac{10}{5} = \boxed{-x - 2}$$

We can now combine more complicated expressions.

Example 7: Simplify each of the following expressions.

$$a) 4(a - 2b + 1) - 5(2a - b - 1) \quad b) 6(2y + 1) - 5(3y - 5) \quad c) 12 \left(\frac{1}{2}x - \frac{3}{4} \right) - 4 \left(\frac{3}{2}x - \frac{5}{4} \right)$$

Solution: a) We apply the distributive law and then combine like terms.

$$4(a - 2b + 1) - 5(2a - b - 1) = 4a - 8b + 4 - 10a + 5b + 5 = \boxed{-6a - 3b + 9}$$

$$b) 6(2y + 1) - 5(3y - 5) = 12y + 6 - 15y + 25 = \boxed{-3y + 31}$$

$$c) 12 \left(\frac{1}{2}x - \frac{3}{4} \right) - 4 \left(\frac{3}{2}x - \frac{5}{4} \right) = 12 \cdot \frac{1}{2}x - 12 \cdot \frac{3}{4} - 4 \cdot \frac{3}{2}x - 4 \cdot \left(-\frac{5}{4} \right) = 6x - 9 - 6x + 5 = \boxed{-4}$$

The last example illustrates the benefits of algebra. If we were asked to evaluate the expression

$12 \left(\frac{1}{2}x - \frac{3}{4} \right) - 4 \left(\frac{3}{2}x - \frac{5}{4} \right)$ when $x = 8, -20, \frac{3}{5}$, or any other number, we might be computing for minutes, but the result will always be -4 . In other words, this expression is **equivalent** to -4 . It is a natural instinct to present and think of expressions in their simplest possible form.



Discussion: Explain how $2x + 3x = 5x$ can be explained in terms of the distributive law.



Sample Problems

- Evaluate each of the following numerical expressions.
 a) $2 - 5(3 - 7)$ b) $24 - 10 + 2$ c) -4^2 d) $(-4)^2$ e) $|3| - |8|$ f) $|3 - 8|$
- Evaluate each of the following algebraic expressions with the value(s) given.
 a) $-x^2 - 5x + 2$ if $x = -2$ b) $-16t^2 + 32t + 240$ if $t = 3$
- Add the algebraic expressions as indicated.
 a) $(3x - 5y) + (2x + 4y)$ b) $(2a - 5b + 3) + (-a - 8b + 3)$
- Multiply the algebraic expressions by a number as indicated.
 a) $3(2x + 4y - 5)$ b) $-5(2a - b + 8)$ c) $-1(-p + 3q - 8m + 6)$ d) $-(-a + 3b - 7)$
- Subtract the algebraic expressions as indicated.
 a) $(2a + b) - (a - b)$ c) $(2m - 5n + 3) - (-m - 8n + 3)$ e) $(3a - 2) - (1 - 4a)$
 b) $(3x - 5y) - (2x + 4y)$ d) $(2a - 2b) - (b - a)$
- Simplify each of the following.
 a) $3(x - 5) - 5(x - 1)$ c) $2(a - 2b) + 3(5b - 2a) - 4(2b - a)$ e) $-(3a - 2) - (1 - 4a)$
 b) $4(2a - b) - 3(5a - 2b)$ d) $\frac{5}{2}(x - y) + \frac{1}{2}(x - 3y)$



Practice Problems

- Evaluate each of the following numerical expressions.
 a) $24 - 5 + 1$ b) $24 \div 3 \cdot 2$ c) -1^2 d) $(-1)^2$ e) $-|4| - |7|$ f) $-|4 - 7|$ g) $6^2 - 4^2$ h) $(6 - 4)^2$
- Evaluate each of the following algebraic expressions with the value(s) given.
 a) $3x^2 - x + 7$ if $x = -1$ b) $-a + 5b$ if $a = 3$ and $b = -2$ c) $\frac{x^x - 1}{x - 1}$ if $x = 2$
- Add the algebraic expressions as indicated.
 a) $(2a - 7y + 1) + (2a - 7y - 1)$ c) $(4p - 5q + 1) + (5p - 4q - 2)$ e) $(-5y + 8) + (5y - 8)$
 b) $(-2a - 5) + (3a + 5)$ d) $(2x - 3y + 8) + (-2x - 3y - 8)$ f) $\left(\frac{1}{2}a + \frac{1}{3}\right) + \left(\frac{1}{2}a - \frac{1}{3}\right)$
- Multiply the algebraic expressions by a number as indicated.
 a) $5(-3a + b - 5)$ b) $0(2x - 7y + 8z)$ c) $-6(n - 3m - 8)$ d) $-(p - 5q + 3r - 1)$
- Subtract the algebraic expressions as indicated.
 a) $(2a - 7y) - (2a - 7y)$ c) $(2x - 5y - 1) - (-y + 1)$ e) $\left(-\frac{1}{3}y + \frac{3}{5}\right) - \left(\frac{1}{3}y - \frac{2}{5}\right)$
 b) $(-2a - 5b - 1) - (3a + 5b - 1)$ d) $(2m - 3n + 8) - (-2m - 3n - 8)$ f) $\left(\frac{1}{2}x + \frac{1}{2}\right) - \left(\frac{1}{2}x - \frac{1}{2}\right)$
- Simplify each of the following.
 a) $(x + 1) - (x - 1)$ c) $-2 + x - 3(x - 1) - (1 - 2x)$ e) $\frac{2}{3}(n - 4m) - \frac{1}{3}(5n + m)$
 b) $2(x - 1) - 3(x - 7)$ d) $-2(a - 3b + c) - 3(a - b + 4c)$



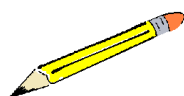
Answers

Sample Problems

1. a) 22 b) 16 c) -16 d) 16 e) -5 f) 5 2. a) 8 b) 192 3. a) $5x - y$ b) $a - 13b + 6$
4. a) $6x + 12y - 15$ b) $-10a + 5b - 40$ c) $p - 3q + 8m - 6$ d) $a - 3b + 7$
5. a) $a + 2b$ b) $x - 9y$ c) $3m + 3n$ d) $3a - 3b$ e) $7a - 3$
6. a) $-2x - 10$ b) $-7a + 2b$ c) $3b$ d) $3x - 4y$ e) $a + 1$

Practice Problems

1. a) 20 b) 16 c) -1 d) 1 e) -11 f) -3 g) 20 h) 4 i) 13 j) 17 2. a) 11 b) -13 c) 3
3. a) $4a - 14y$ b) a c) $9p - 9q - 1$ d) $-6y$ e) 0 f) a
4. a) $5b - 15a - 25$ b) 0 c) $-6n + 18m + 48$ d) $-p + 5q - 3r + 1$
5. a) 0 b) $-5a - 10b$ c) $2x - 4y - 2$ d) $4m + 16$ e) $1 - \frac{2}{3}y + 1$ f) 1
6. a) 2 b) $-x + 19$ c) 0 d) $-5a + 9b - 14c$ e) $-3m - n$



Solutions - Sample Problems

1. Evaluate each of the following numerical expressions.

a) $2 - 5(3 - 7)$

Solution: We will apply order of operations. First we perform the subtraction in the parentheses.

$$\begin{aligned}
 2 - 5(3 - 7) &= && \text{subtraction in parentheses} \\
 2 - 5(-4) &= && \text{multiplication} \\
 2 - (-20) &= && \text{subtraction} \\
 2 + 20 &= \boxed{22}
 \end{aligned}$$

b) $24 - 10 + 2$

Solution: It is NOT true that addition comes before subtraction. Addition and subtraction are equally strong, so between those two, we perform them left to right. First come, first served.

$$24 - 10 + 2 = 14 + 2 = \boxed{16}$$

c) -4^2

Solution: as it was discussed before, -4^2 is quite different from $(-4)^2$. This is $-1 \cdot 4^2 = \boxed{-16}$.

d) $(-4)^2$

This is when -4 is squared. So $(-4)^2 = -4(-4) = \boxed{16}$

e) $|3| - |8|$

Solution: We subtract the absolute value of 8 from the absolute value of 3. So $|3| - |8| = 3 - 8 = \boxed{-5}$

f) $|3 - 8|$

Solution: This is the absolute value of the difference. Absolute value signs also function of grouping symbols (i.e. parentheses) to overwrite the usual order of operations. So $|3 - 8| = |-5| = \boxed{5}$

2. Evaluate each of the following algebraic expressions with the value(s) given.

a) $-x^2 - 5x + 2$ if $x = -2$

Solution: We substitute -2 into the expression. Please note that if the value of x is negative, we will need to place parentheses around it.

$$-x^2 - 5x + 2 = -(-2)^2 - 5(-2) + 2$$

According to order of operations, we perform the exponentiation first.

$$-(-2)^2 - 5(-2) + 2 = -4 - 5(-2) + 2 = -4 - (-10) + 2 = -4 + 10 + 2 = 6 + 2 = \boxed{8}$$

Why don't the two minuses make a plus in $-(-2)^2$? They do, it's just that there are three minus signs and not two: $-(-2)^2 = -1(-2)(-2)$.

b) $-16t^2 + 32t + 240$ if $t = 3$

Solution: We substitute 3 into the expression. Please note that if the value of x is negative, we will need to place parentheses around it.

$$\begin{aligned} -16t^2 + 32t + 240 &= -16(3)^2 + 32(3) + 240 \\ &= -16 \cdot 9 + 32 \cdot 3 + 240 \\ &= -144 + 96 + 240 = -48 + 240 = \boxed{192} \end{aligned}$$

3. Add the algebraic expressions as indicated.

a) $(3x - 5y) + (2x + 4y)$

Solution: We drop the parentheses and combine like terms.

$$\begin{aligned} (3x - 5y) + (2x + 4y) &= \\ 3x - 5y + 2x + 4y &= && \text{organize like terms together} \\ 3x + 2x - 5y + 4y &= && 3 + 2 = 5 \quad \text{and} \quad -5 + 4 = -1 \\ &= \boxed{5x - y} \end{aligned}$$

b) $(2a - 5b + 3) + (-a - 8b + 3)$

Solution: We drop the parentheses and combine like terms.

$$\begin{aligned} (2a - 5b + 3) + (-a - 8b + 3) &= \\ 2a - 5b + 3 - a - 8b + 3 &= \\ 2a - a - 5b - 8b + 3 + 3 &= && 2 - 1 = 1, \quad -5 - 8 = -13, \quad \text{and} \quad 3 + 3 = 6 \\ 1a - 13b + 6 &= \boxed{a - 13b + 6} \end{aligned}$$

4. Multiply the algebraic expressions by a number as indicated.

a) $3(2x + 4y - 5)$

Solution: We distribute 3 .

$$3(2x + 4y - 5) = \boxed{6x + 12y - 15}$$

b) $-5(2a - b + 8)$

Solution: We distribute -5 .

$$-5(2a - b + 8) = \boxed{-10a + 5b - 40}$$

c) $-1(-p + 3q - 8m + 6)$

Solution: We distribute -1 .

$$-1(-p + 3q - 8m + 6) = \boxed{p - 3q + 8m - 6}$$

d) $-(-a + 3b - 7)$

Solution: The notation here indicates multiplication by -1 , which is the same as taking the opposite of a quantity. We distribute -1 .

$$-1(-a + 3b - 7) = \boxed{a - 3 + 7}$$

5. Subtract the algebraic expressions as indicated.

a) $(2a + b) - (a - b)$

Solution: To subtract is to add the opposite. The opposite of $a - b$ is $-a + b$ since

$$-1(a - b) = -a + b$$

$$\begin{aligned} \text{Thus } (2a + b) - (a - b) &= (2a + b) + (-a + b) && \text{drop parentheses} \\ &= 2a + b - a + b && \text{combine like terms} \\ &= \boxed{a + 2b} \end{aligned}$$

b) $(3x - 5y) - (2x + 4y)$

Solution: To subtract is to add the opposite. The opposite of $2x + 4y$ is $-2x - 4y$ since

$$-1(2x + 4y) = -2x - 4y$$

$$\begin{aligned} (3x - 5y) - (2x + 4y) &= (3x - 5y) + (-2x - 4y) && \text{to subtract is to add the opposite} \\ &= 3x - 5y - 2x - 4y && \text{drop parentheses, combine like terms} \\ &= \boxed{x - 9y} \end{aligned}$$

c) $(2m - 5n + 3) - (-m - 8n + 3)$

Solution: To subtract is to add the opposite. The opposite of $-m - 8n + 3$ is $m + 8n - 3$ since

$$-1(-m - 8n + 3) = m + 8n - 3$$

$$\begin{aligned} (2m - 5n + 3) - (-m - 8n + 3) &= && \text{to subtract is to add the opposite} \\ (2m - 5n + 3) + (m + 8n - 3) &= && \text{drop parentheses, combine like terms} \\ 2m - 5n + 3 + m + 8n - 3 &= \boxed{3m + 3n} \end{aligned}$$

d) $(2a - 2b) - (b - a)$

Solution: To subtract is to add the opposite. The opposite of $b - a$ is $-b + a$ since

$$-1(b - a) = -b + a$$

$$\begin{aligned} (2a - 2b) - (b - a) &= (2a - 2b) + (-b + a) && \text{to subtract is to add the opposite} \\ &= 2a - 2b - b + a && \text{drop parentheses, combine like terms} \\ &= \boxed{3a - 3b} \end{aligned}$$

e) $(3a - 2) - (1 - 4a)$

Solution: To subtract is to add the opposite. The opposite of $1 - 4a$ is $-1 + 4a$ since

$$-1(1 - 4a) = -1 + 4a$$

$$\begin{aligned} (3a - 2) - (1 - 4a) &= && \text{to subtract is to add the opposite} \\ (3a - 2) + (-1 + 4a) &= && \text{drop parentheses, combine like terms} \\ 3a - 2 - 1 + 4a &= \boxed{7a - 3} \end{aligned}$$

6. Simplify each of the following.

a) $3(x - 5) - 5(x - 1)$

Solution: We apply the law of distributivity and combine like terms. Notice that the last term is $-5(-1) = 5$.

$$\begin{aligned} 3(x - 5) - 5(x - 1) &= && \text{apply the distributive law} \\ 3x - 15 - 5x + 5 &= && \text{combine like terms} \\ &= \boxed{-2x - 10} \end{aligned}$$

b) $4(2a - b) - 3(5a - 2b)$

Solution: We apply the law of distributivity and combine like terms

$$\begin{aligned} 4(2a - b) - 3(5a - 2b) &= 8a - 4b - 15a + 6b \\ &= \boxed{-7a + 2b} \end{aligned}$$

c) $2(a - 2b) + 3(5b - 2a) - 4(2b - a)$

Solution: We apply the law of distributivity and combine like terms

$$2(a - 2b) + 3(5b - 2a) - 4(2b - a) = 2a - 4b + 15b - 6a - 8b + 4a = \boxed{3b}$$

d) $\frac{5}{2}(x - y) + \frac{1}{2}(x - 3y)$

Solution: We apply the law of distributivity and combine like terms

$$\begin{aligned} \frac{5}{2}(x - y) + \frac{1}{2}(x - 3y) &= && \text{apply the distributive law} \\ \frac{5}{2}x - \frac{5}{2}y + \frac{1}{2}x - \frac{1}{2} \cdot 3y &= \\ \frac{5}{2}x + \frac{1}{2}x - \frac{5}{2}y - \frac{3}{2}y &= && \text{combine like terms} \quad \frac{5}{2} + \frac{1}{2} = 3 \quad -\frac{5}{2} - \frac{3}{2} = -4 \\ \frac{6}{2}x - \frac{8}{2}y &= \boxed{3x - 4y} \end{aligned}$$

e) $-(3a - 2) - (1 - 4a)$

Solution:

$$\begin{aligned} -(3a - 2) - (1 - 4a) &= -1(3a - 2) - 1(1 - 4a) && \text{multiplication} \\ &= -3a + 2 - 1 + 4a && \text{combine like terms} \\ &= \boxed{a + 1} \end{aligned}$$