These notes are prepared using software that is designed for typing mathematics; it produces a pdf output. Alternative format is not available. (Text based files supplied to visually impaired students upon request.)

Our course starts with an algebra review. A lot of this material should be familiar to you. Please be careful about judging the difficulty of the entire course, based on the first few days of material. We’re going to work an example from Obj 1b, then go back to the Preliminary Objectives and fill in some of the concepts. I’ll also show you a few problems from later in the semester.

Simplify. \[\frac{2x^2 - 5x - 12}{24x^2 - 6x^3} \div \frac{9 - 4x^2}{4x - 20}\]

Preliminary Objective 1 The relationship between \(a - b\) and \(b - a\)

\[-1(a - b) = \]

\[-1(b - a) = \]

Conclusion? They are \underline{____________} or \underline{____________} of each other.

Simplify. \[\frac{5}{-5} = \frac{-8}{8} = \frac{x - 1}{1 - x} = \frac{3 - 2x}{2x - 3} = \]

Note. \[\frac{a + b}{b + a} = \]
**Preliminary Objective 2** Factoring Quadratic Trinomials

Note: Many of the problems in our course contain a “hint” for the trinomial factoring. Use It!

Before we factor, recall how to multiply two binomials. **F O I L**

**Multiply.** \((6x - 5)(2x + 3)\)  \((6x - 5)(2x - 3)\)

We’ll use Reverse **F O I L** in order to factor. For some problems, one factor will be known - you will need to determine the other. For some problems, you have to be able to factor with no “hint”.

**An on-line example.**

For \(18x^2 - 19x - 12\), one of the factors is \(2x - 3\), find the other factor.

\[18x^2 - 19x - 12 = \]

This problem is in Ntuple mode - enter an ordered pair.

**Factor.** \(18x^2 - 51x + 8\)  \(24x^2 - 7x - 5\)

These problem are in MultiFormula mode; enter factors separated by semicolon.

**Objective 1** Rational Expressions - fractions made up of ________________.

(Note: Values that cause division by zero are called “restrictions on the variable”. We’ll do more with this concept when we study function domains in Obj 10c. We will not list restrictions on the vbl as we work in Obj 1.)
Recognizing Equivalent Rational Expressions

In particular, dealing with a pesky minus sign when it appears in front of a fraction.

Consider a numerical fraction \(-\frac{2}{3}\)

We will ask “Which are equivalent to” the given expression, and the problems will be in Multiple Selection mode. You will choose all that are equivalent; if none are, then select that choice.

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Plan of Attack Generate equivalent expressions by distributing the minus through the \(\square\), then separately through the \(\square\). Compare these with the answer choices.

Keep in mind Prelim. Obj 1: \(-(a - b) = b - a\)

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Which are equivalent to
\[-\frac{x - 1}{x - 6}\]

Answer choices:
\[-\frac{x - 1}{-x + 6}\]
\[-\frac{x - 1}{6 - x}\]
\[\frac{1 - x}{x - 6}\]
\[-\frac{x - 1}{-x + 6}\]

None are equivalent

Which are equivalent to
\[-\frac{x + z}{x - z}\]

Answer choices:
\[\frac{x + z}{z - x}\]
\[-\frac{x + z}{-x - z}\]
\[\frac{z + x}{-x + z}\]
\[-\frac{z - x}{x - z}\]

None are equivalent
Objective 1b Multiply/Divide Rational Expressions

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Plan of Attack Factor Everything! Three types of factoring:
Factor a trinomial; Always factor it _____ Use the hints provided by the other factors.
Remove the GCF.
Factor the Difference of Two Perfect Squares: $x^2 - y^2 = $

When cancelling common factors, remember Prelim. Obj. 1: $\frac{a - b}{b - a} = -1$

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Simplify. $\frac{2x^2 - 5x - 12}{24x^2 - 6x^3}$

Simplify. $\frac{9 - 4x^2}{4x - 20}$

Simplify. $\frac{20x^2 - 23x + 6}{9 - 16x^2} \cdot \frac{10x}{4x^2 - 10x^3}$

Simplify. $\frac{25 - 4x^2}{3x} \frac{2x^2 - 13x + 20}{6x^2 - 24x}$
**Objective 1c** Add/Subtract Rational Expressions

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**Plan of Attack** Use the Least Common Multiple to create a common denominator in each fraction. Determine the LCM. For terms containing the variable, use the highest power in any one denominator.

Create the common denom in each by comparing each fraction’s denom with the LCM, and then by multiplying each fraction top-and-bottom by the part missing from the LCM.

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Simplify. \( \frac{2}{6x} - \frac{1}{8x^2} \) \hspace{1cm} Simplify. \( \frac{5}{6x} - \frac{7}{9x^2} - \frac{x}{18} \)

Simplify. \( \frac{1}{9x^4} + \frac{2}{12x^2} \)

Simplify. \( \frac{8}{x^2 - 4x - 12} - \frac{19}{2x^2 - 5x - 42} \)

Simplify. \( \frac{-19}{3x^2 - 11x - 20} - \frac{7}{x^2 - 3x - 10} \)
Simplify. \( \frac{3x - 4}{4x^2 - 3x - 10} + \frac{3}{4x + 5} \)

Simplify. \( \frac{3x - 5}{3x^2 + 2x - 1} - \frac{3}{1 - 3x} \)

Simplify. \( \frac{8x - 19}{5x^2 + 29x - 6} + \frac{3}{1 - 5x} \)

Simplify. \( \frac{13x - 4}{6x^2 - 11x - 10} + \frac{3}{5 - 2x} \)

**Objective 1d** Simplify mixed quotients (complex fractions)

There are two common methods used for simplifying mixed quotients. I’ll demonstrate the method that I think is best; both methods are shown on the video clips for this objective.

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**Plan of Attack** Determine the LCM of all fractions.

Multiply top and bottom of the big fraction by the LCM of all.

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Simplify. \( \frac{3}{\frac{d - c}{3} - \frac{3}{c}} \)
Simplify. \( \frac{1}{w+y} - \frac{1}{y} \) \( \frac{1}{w+y} \)

Simplify. \( \frac{1}{a+6} \) \( \frac{1}{a+6} - \frac{1}{6} \)

Simplify. \( \frac{1}{x+4} \) \( 1 - \frac{1}{x+4} \)

Simplify. \( \frac{1}{y-1} \) \( \frac{1}{y-1} \)
Write in simplest radical form. Rationalize the denominator; simplify and reduce completely. Enter the numerator only of the final answer. If negative, the minus sign must be entered with the numerator. For example, $\frac{3\sqrt{2}-5}{2} = -\frac{(3\sqrt{2}-5)}{2}$. The answer must be entered as $-(3\sqrt{2}-5)$ or as $-3\sqrt{2} + 5$.

\[
\frac{5 - \frac{1}{\sqrt{5}}}{1 + \frac{1}{\sqrt{5}}}
\]

\[
\frac{3 + \frac{3}{\sqrt{3}}}{1 - \frac{5}{\sqrt{3}}}
\]

\[
\frac{1}{\sqrt{5}} - 5
\]

\[
\frac{1}{\sqrt{5}} + 1
\]
Objective 2
Simplify numbers raised to rational exponents

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Plan of Attack
Rewrite using the definitions below.
Remember that $a^{-n} = \frac{1}{a^n}$.
Remember Order of Operations!

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Definition

$a^{1/n} =$ Provided the root exists (i.e. is a real number).

$a^{m/n} =$

Simplify.

$27^{1/3} =$

$(-32)^{1/5} =$

$(16)^{1/4} =$

$(-25)^{1/2} =$

$-25^{1/2} =$

$-27^{2/3} =$

$-49^{-3/2} =$

$-(\frac{100}{9})^{-3/2} =$

$\left(\frac{-27}{64}\right)^{-4/3} =$

$(-256)^{-3/4} =$

$-256^{-3/4} =$
Objective 3 Special Factoring Techniques

Obj 3a Factoring by Grouping (Typically used when expression has 4 terms).

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Plan of Attack Group the first two terms together and remove the GCF. Group the last two terms together and remove the GCF. The binomials must match. Sometimes you have to rearrange the terms; try rearranging the two middle terms.

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Factor. $3x + 3y - xy - x^2$

Which of the following is a factor of $3x + 3y - xy - x^2$? (“Is a factor of” means which would divide evenly into the given expression.)

$x - y$ $3 - x$ $y - x$ $3 + y$ $3 + x$ $x - 3$ $y + x$

Factor. $ax^2 + by^2 - ay^2 - bx^2$

Which of the following is a factor of $ax^2 + by^2 - ay^2 - bx^2$? (“Is a factor of” means which would divide evenly into the given expression.)

$x - y$ $a + b$ $y - x$ $a - b$ $x + y$ $b - a$
Factor. $xy + 3y + x + 3$

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**Obj 3b** Remove the GCF with rational exponents

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**Plan of Attack** Use the __________ exponent.

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Factor. $24x^{-3} - 22x^{-2} - 10x^{-1}$

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Factor. Which is a factor of $24x^{-1} - 22x^{-2} + 10x^{-3}$?

- $4x - 5$
- $4 - 5x$
- $3x + 1$
- none of these

Factor. $27x^{-2} - 12x^{-3}$

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Factor. $x^{5/4} - 5x^{1/4} - 6x^{-3/4}$
**Factor.** Which is a factor of $8x^{1/2} + 2x^{-3/2}$?

2$x - 1$  $4x + 1$  $2 - x$  none of these

**Factor.** $4x^{1/2} − 12x^{-3/2} + 8x^{-7/2}$

**Obj 3c** Remove the GCF - common binomial and rational exponents

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**Plan of Attack** Simplify first, when needed.

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Simplify. $\frac{5(3x + 1)^3 − 6(x − 1)(3x + 1)^2}{(3x + 1)^8}$

Simplify. $\frac{4(2x − 1)(x − 2)^2 + 3x(x − 2)^3}{(x − 2)^4}$

Simplify. $\frac{4(2x − 1)^4 + 3x(x + 2)(2x − 1)^3}{(2x − 1)^3}$
Factor. $x^2(3x^3 + 1)^{2/5}(4x) + (3x^3 + 1)^{7/5}$

Factor. $(2x^3 + 1)^{8/3} + x(2x^3 + 1)^{5/3}(3x^2)$

Factor. $x^3(x^2 + 3)^{1/5}(2x) + (x^2 + 3)^{6/5}$

Objective 4 Review of Equation Solving

Obj 4a Linear Equations

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Plan of Attack Remove grouping symbols; Collect like terms; Isolate variable

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Solve. $2x - 3(x - 4) = 5(x - 3) + 9$  

Solve. $5x + 3(6 - x) = 3(2x - 1) - 4x$
Obj 4b Quadratic Equations: $ax^2 + bx + c = 0$

Obj 4b Method 1 - by Factoring

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Plan of Attack Write in standard form - if needed. Remember that you can always use the Quadratic Formula - you don’t have to solve by factoring.

Use the Zero Factor Property: If $a \cdot b = 0$, then __________________

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Solve. $8x^2 - 15 = 14x$ Solve. $24x^2 - 83x + 25 = 0$

Obj 4b Method 2 - by Square-Root Property

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Plan of Attack Used to solve quadratic equations is this special form: $a(bx + c)^2 + d = 0$.

Do not _______________ _______ !

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Enter answers in any order separated by semicolon. If there is no solution, enter the words no solution with no capital letters, no quotation marks, and no punctuation marks.

Use the preview button - let it help you. Be patient - give time to load.

Solve. $-3(2x + 1)^2 + 6 = 0$ Solve. $3(2x - 1)^2 - 12 = 0$
Obj 4b Method 3 - by Quadratic Formula

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**Plan of Attack** Be sure the quadratic is in standard form. Must correctly identify $a$, $b$, and $c$.

For $ax^2 + bx + c = 0$, $x =$

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**eGrade Problem Instructions:** You must simply and reduce completely; you must simplify so that $d > 0$. The solution will be entered as an ordered 4-tuple $(a, b, c, d)$ where $a$, $b$, $c$, $d$ are given by $\frac{a \pm b\sqrt{c}}{d}$ in the final simplified answer. You must always enter four numbers; you must enter 1 where needed.

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If $a < 0$, then you should multiply both sides of the equation by $-1$ before using the quadratic formula.

**Solve.** $4x^2 + 2x = 1$

**Solve.** $x^2 - 6x + 3 = 0$
Solve. \(-3x^2 + 6x - 1 = 0\) \hspace{2cm} \text{Solve.} \quad x^2 - 3x + 5 = 0

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**Obj 4c** (Simple) Rational Equations \[ \frac{\text{single fraction}}{} = \frac{\text{single fraction}}{} \]

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**Plan of Attack** Just ___________ ___________

Values that cause division by zero are called “restrictions on the variable”. We’ll do more with this concept when we study function domains in Obj 10c. We will not test you on this concept here.

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**Solve.** \[ \frac{3x - 2}{x + 1} = \frac{1}{2} \]

**Solve.** \[ \frac{3x - 2}{x + 1} = 0 \]

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**Obj 4d** Solving higher order (degree) equations: \textit{monomial} = \textit{monomial}

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**Plan of Attack** Our question will be: “How many distinct real solutions are there?” You answer that question by ___________ and ___________

FACTOR! Bring both terms to the left, remove the GCF, use the Zero-Factor Property.

Note: If the right side is a constant, then you don’t need to factor - the equation is ready to solve.

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Solve. \( x^7 = 16x^3 \)  
Solve. \( x^5 = -27x^2 \)

Solve. \( x^4 = 7x^2 \)  
Solve. \( x^8 = 20x^3 \)

Solve. \( x^3 = 11 \)  
Solve. \( x^6 = -2 \)

Solve. \( x^6 = 12x^2 \)  
Solve. \( x^4 = 9x \)

Solve. \( x^5 = 25 \)  
Solve. \( x^8 = -8 \)
Obj 4e (Simple) Equations with radicals (one radical in equation)

Obj 4e Odd Root

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Plan of Attack No ___________ with Odd Root. Raise both sides of the equation to the appropriate integer power to remove the radical. Odd Root - Don’t have to check solutions.

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Solve. $\sqrt[3]{8x + 1} = -7$  Solve. $\sqrt[3]{x + 5} = 2$

Obj 4e Even Root

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Plan of Attack Even Root - Must check solutions.

$even\sqrt{\text{must be positive}}$ and $even\sqrt{\text{positive}} = \text{positive number only}$

After you raise both sides to an even power, the solutions to the resulting equation may not meet the requirements given above. Such solutions are called extraneous.

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Solve. $\sqrt{2x + 6} = -6$  Solve. $\sqrt{2 - 3x} = 7$

Solve. $\sqrt{x + 6} = -x$  Solve. $\sqrt{11 - 5x} = 3 - x$
Solve. $\sqrt{4-x} = -5$  
Solve. $\sqrt{2x+1} = 6$

Solve. $\sqrt{2x+3} = -x$  
Solve. $\sqrt{10-x} = x - 4$

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**Objective 5** Linear Inequalities, Interval Notation, And and Or

**Obj 5b** Interval Notation - Used to represent the solution to inequalities.

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**Please Note** Inequalities are easier to read if the variable is on the _______.
Interval Notation is always written in ________________________.

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Express in interval notation.

$x \leq -\frac{1}{2}$

$\frac{3}{2} < x$

$\frac{9}{2} > x \geq 0$
**Obj 5c** The math terms “And” and “Or”

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**Plan of Attack** Draw a “picture” of the two sets on a number line, then check if “And” or “Or”.

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A  B
```

```
A  B
```

“OR” means

“AND” means

Express in interval notation. \( 3 \leq x \) and \( x > 5 \)

Express in interval notation. \( x \geq 3 \) and \( x < 5 \)

Express in interval notation. \( x \geq 3 \) or \( x < 5 \)

Express in interval notation. \( x \leq 3 \) or \( x > 5 \)

Express in interval notation. \( x \leq 3 \) and \( x > 5 \)
**Obj 5a** Solve Linear Inequalities

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**Plan of Attack** Like Linear Equations: Remove grouping symbols; Collect like terms; Isolate variable

Unlike Linear Equations: If you ever multiply or divide by a negative number, must _________ the inequality sign.

Inequalities are easier to read if the variable is on the _________.

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**Solve.** \(2 + 2(x - 6) \geq 4(x - 5) + 12\) \hspace{1cm} **Solve.** \(-5 < 6 - 2(x + 1) \leq 4\)

**Solve.** \(5 > 1 - \frac{1}{2}x > 15 + \frac{3}{2}x\) \hspace{1cm} **Solve.** \(-26 - 3x < 2x - 1 < 9 - 3x\)

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**Objective 6** Rectangular Coordinate System; Distance and MidPoint Formulas

**Obj 6a** Rectangular Coordinate System

The notation \(P(x, y)\) is used to refer to a point in the coordinate plane.

It is an ____________________________.

Plot \((3, 4)\) \quad \((-3, 1)\) \quad \((0, 5)\) \quad \((-6, 0)\)
**Obj 6b** Distance Formula

Find the distance between the points $P(-1, -12)$ and $Q(3, -4)$.

Find the distance between the points $P(-4, -4)$ and $Q(8, -13)$.

**Obj 6c** Mid-Point Formula

Find the midpoint of the line segment joining $P(3, -2)$ and $Q(-7, 1)$.

Find the midpoint of the line segment joining $P(-x, 0)$ and $Q(0, y)$. 
**Obj 7** General Graphing Principles

**Obj 7a** Point on a graph.

If \((a, b)\) is on the graph of an equation (a relationship between \(x\) and \(y\)). then when \(\text{________________} \) and \(\text{________________} \) the equation is satisfied.

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**Plan of Attack** \(\text{____________} \) \(\text{____________} \). \(\text{____________} \) \(\text{____________} \)

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If \((6, c)\) is on the graph of \(y^2 = x + 3\), find the value of \(c\).

If \((c, -27)\) is on the graph of \(x^3 = y + 3\), find the value of \(c\).

**Obj 7b** Intercepts

Intercepts - Points where a graph \(\text{____________} \) or \(\text{____________} \) a coordinate axis.

List all intercepts for each graph.

![Graph 1](image1)

![Graph 2](image2)

Find all intercepts (algebraically).

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**Plan of Attack** For \(x\)-intercepts, let \(\text{__________} \), solve for \(x\).

For \(y\)-intercepts, let \(\text{__________} \), solve for \(y\).

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Find all intercepts. \(x + y^3 + y^2 = 0\)
Find all intercepts. \( x^2 + 3y^3 = -27 \)

**Obj 7c Symmetry**

**Symmetry with respect to x-axis**
To test algebraically,

See if an equivalent equation results.

**Symmetry with respect to y-axis**
To test algebraically,

See if an equivalent equation results.

**Symmetry with respect to Origin**
To test algebraically,

See if an equivalent equation results.

**An on-line example of one type of Symmetry problem.** If \((3, -6)\) is a point on the graph of a relation (equation with \(x\) and \(y\)) that is symmetric with respect to the \(x\)-axis, which of these must also be on the graph?

\((-3, -6)\) \((3, 6)\) \((-3, 6)\)
Test for Symm wrt y-axis. \(x^2y = x^2 + 3\)  

Test for Symm wrt Origin. \(y = x^2y + 3x\)

Test for Symm wrt Origin. \(y^3 = \frac{y}{x^2 + 1}\)

An on-line example. **Which of the following is symm wrt the x-axis.**
\[y = 3x - 2\]  
\[y = \frac{x^2}{2 - 5x}\]

\[x = 2y^2 + 5\]  
\[x^4 = y^3 - 2y^2 + y + 5\]
**Objective 8** Linear Equations

**Obj 8a** Slope

The slope of the line through \((x_1, y_1)\) and \((x_2, y_2)\)

\[
\text{Gives the } \underline{\quad} \text{ and } \underline{\quad}\text{ of the slant of the line.}
\]

**Find the slope of the line through:**

\((-4, 6)\) and \((2, -7)\) \hspace{1cm} \((-4, 6)\) and \((-4, 2)\) \hspace{1cm} \((3, 2)\) and \((0, 2)\)

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**Obj 8e** Writing the Equation of a line

How do we determine the algebraic rule that defines a particular line (the \(xy\) equation of a line)?

Each line is uniquely determined by \(\underline{\quad}\) and the \(\underline{\quad}\).

The equation of the line through \((x_1, y_1)\) with slope \(m\) is given by

\[
y - y_1 = m(x - x_1) \quad Ax + By = C \quad y = mx + b
\]

**Obj 8e** Write an equation of the line that goes through \((-1, 3)\) and has slope \(m = 2\). Express answer in standard form. eGrade Instructions: Please remember that standard form is \(Ax + By = C\), where \(A, B, C\) are integers and \(A > 0\). Enter the values \(A, B, C\) as an ordered 3-tuple \((A, B, C)\).
Obj 8e Write an equation of the line that goes through \((-6, -3)\) and has slope \(m = -\frac{5}{7}\). Express answer in standard form.

Obj 8e Write an equation of the line that goes through \((-3, 9)\) and \((12, -1)\). Express answer in slope-intercept form. eGrade Instructions: (Enter only the right hand side of the expression. Use proper or improper fractions or exact decimals; mixed fractions and decimal approximations are not allowed.)

Obj 8e Write an equation of the line that goes through \((0, b)\) and has slope \(m\). Express answer in slope-intercept form.

Obj 8c Identify the slope of a line.
Write in slope-intercept form. \(\underline{\text{\phantom{}}}\). (Unless special cases of vertical or horizontal line; see below.)

Find the slope of the line \(2x - y = -5\)

Obj 8b Graph of Linear Equation

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Plan of Attack Just find the \(\underline{\text{\phantom{}}}\).
It isn’t necessary to put in slope-intercept form.
Which of the following most closely resembles the graph of \(2x - y = -5\)

![Graphs of equations](image1.png)

**Obj 8b** Which of the following most closely resembles the graph of \(11x + 3y = -36\)

![Graphs of equations](image2.png)

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**Obj 8d** Summary of facts for Vertical and Horizontal lines.

*Horizontal line* has equation \(y = \text{constant}\), has slope \(0\), except for \(x\)-axis has \(\text{undefined}\).

*Vertical line* has equation \(x = \text{constant}\), has slope \(\text{undefined}\), except for \(y\)-axis has \(0\).

**Obj 8c** Find the slope of the line:
\[
\begin{align*}
  x &= -4 \\
  x &= \sqrt{3} \\
  y &= 5 \\
  y &= \pi
\end{align*}
\]

**Obj 8d** Write an equation of the line that goes through \((-2, 4)\) that has undefined slope.

**Obj 8d** Write an equation of the line that goes through \((-2, 4)\) that has no \(x\)-intercepts.

**Obj 8d** Write an equation of the line that goes through \((-5, 1)\) and \((-5, 4)\).
Obj 8f Using slope of parallel or perpendicular lines to write an equation of a line.

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Plan of Attack
For nonvertical lines:
Parallel lines have the ____________________________.
Perpendicular lines have slopes whose ____________________________.

For example, if a line has slope $m = -\frac{3}{5}$, then a line that’s perpendicular has slope ____________________________.

For vertical lines, we must use geometry. Two vertical lines are parallel - they never intersect.
A vertical line and a horizontal are perpendicular - they intersect in a 90° angle.

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Obj 8f Write an equation of the line that goes through $(-2, 5)$ that’s perpendicular to the line $8x - 3y = -7$. (The multiple choices are all in standard form, A,B,C, integers and $A > 0$.)

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Obj 8e Linear Applications (Writing the equation of a line.)

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Plan of Attack
When written in slope-intercept form, we say ____________________________.
The “express” sentence tells you how to set up the ordered pairs. You cannot ____________________________.

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Obj 8f Write an equation of the line that goes through $(4, -3)$ and is parallel to $y = \frac{1}{5}x - 1$.

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Obj 8f Write an equation of the line that goes through $(-1, 5)$ that’s parallel to the line $x = 3$. 

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Obj 8e Linear Applications (Writing the equation of a line.)

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Plan of Attack
When written in slope-intercept form, we say ____________________________.
The “express” sentence tells you how to set up the ordered pairs. You cannot ____________________________.
As one descends into the ocean, pressure increases linearly. The pressure is 15 pounds per square inch, on the surface, and 30 pounds per square inch, 33 feet below the surface. Express the pressure $p$ (in pounds per square inch) in terms of the depth $d$ (in feet below the surface). (Enter only the right hand side of the expression. Use correct variable. Use proper or improper fractions (no mixed fractions) or exact decimals. Do not give decimal approximations.)

Blue whales weigh approximately 2 tons when newborn. Young whales are nursed for 9 months, and by the time of weaning, they often weigh 25 tons. Let $w$ denote the weight of the whale in tons and let $a$ be the age of the whale in months. If the weight is linearly related to the age, express $w$ in terms of $a$. (Same on-line cautions shown in first example.)

The volume $v$ (in cubic centimeters) of a gas varies linearly with temperature $t$ (in degrees Celsius). At a temperature of $12^\circ C$ a gas occupies a volume of $280cm^3$. When warmed to $66^\circ C$, the gas occupies a volume of $361cm^3$. Express $v$ in terms of $t$. (Same eGrade cautions shown in first example.)

The volume $v$ (in cubic centimeters) of a gas varies linearly with temperature $t$ (in degrees Celsius). At a temperature of $12^\circ C$ a gas occupies a volume of $280cm^3$. When warmed to $66^\circ C$, the gas occupies a volume of $361cm^3$. Express $t$ in terms of $v$. (Same eGrade cautions shown in first example.)
A peanut farmer finds that at an average cost of $3 per bushel, 300 bushels can be produced; 1200 bushels can be produced at an average of $2 per bushel. Assuming that the cost per bushel, \( c \) and the number of bushels, \( n \), are linearly related. Express \( c \) in terms of \( n \).

**Obj 9** Center-Radius Form of the Equation of a Circle

Identify the center and radius.

\[
(x - 3)^2 + (y - 2)^2 = 25 \\
(x - 2)^2 + (y + 1)^2 = 5 \\
x^2 + (y + 3)^2 = 4
\]