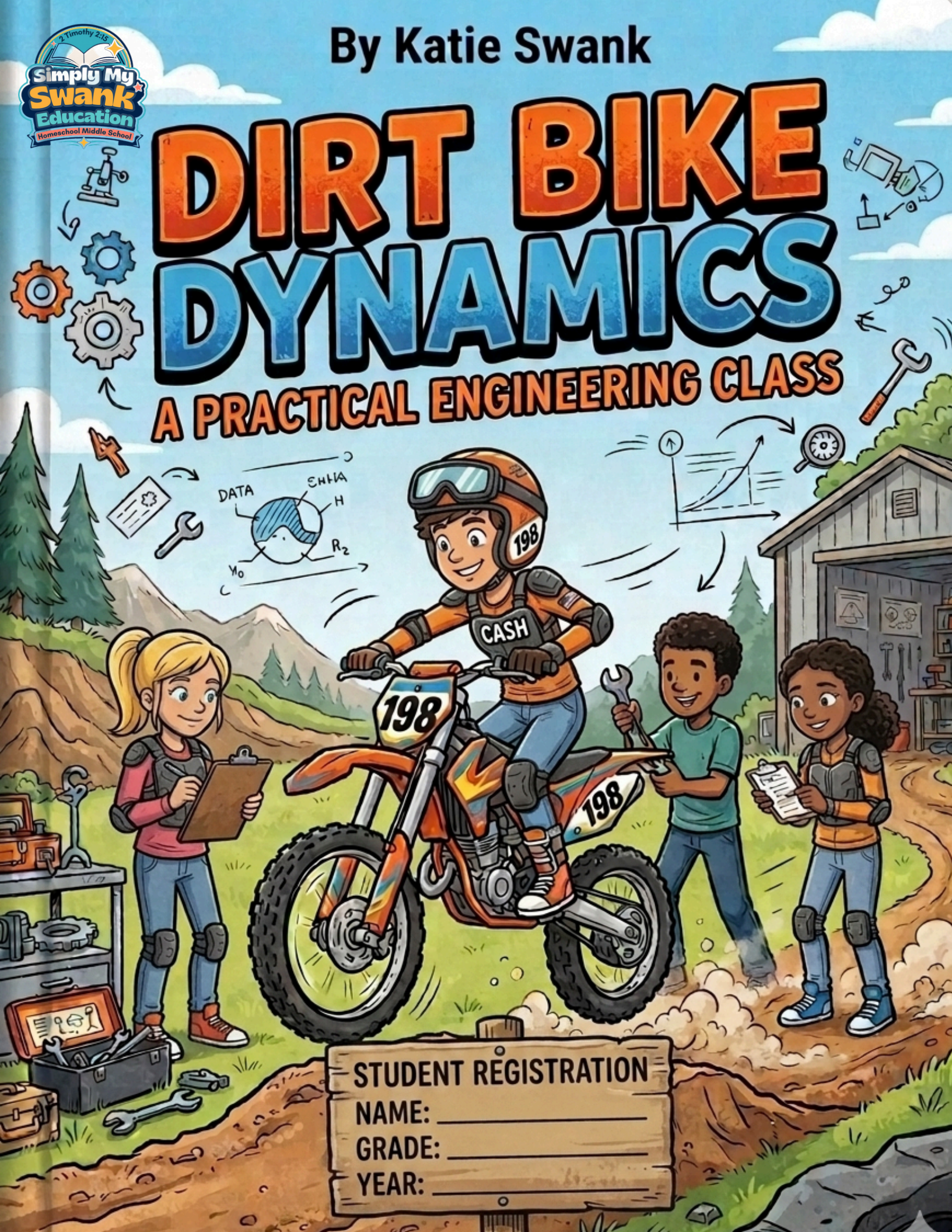


By Katie Swank

DIRT BIKE DYNAMICS

A PRACTICAL ENGINEERING CLASS



STUDENT REGISTRATION

NAME: _____

GRADE: _____

YEAR: _____



Executive Summary: Dirt Bike Dynamics

The Ultimate Middle-School STEM & Character Blueprint

Dirt Bike Dynamics transforms abstract physical science concepts into high-octane, tangible realities by utilizing the mechanical systems of a motocross bike as a living laboratory.

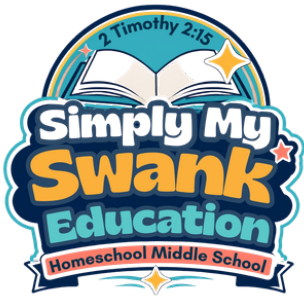
Designed specifically to capture the attention of middle school students, this workbook bridges the gap between mandatory academic science standards and real-world, hands-on engineering, all while anchoring every lesson in a timeless moral and spiritual foundation.

Core Purpose & Mission:

The primary goal of this workbook is to make science irresistible, practical, and meaningful. Instead of memorizing definitions from a chalkboard, students climb into the mechanic's pits to diagnose everyday mechanical problems.

By framing physics through action sports, the curriculum naturally answers the age-old middle school question: "When am I ever going to use this in real life?"



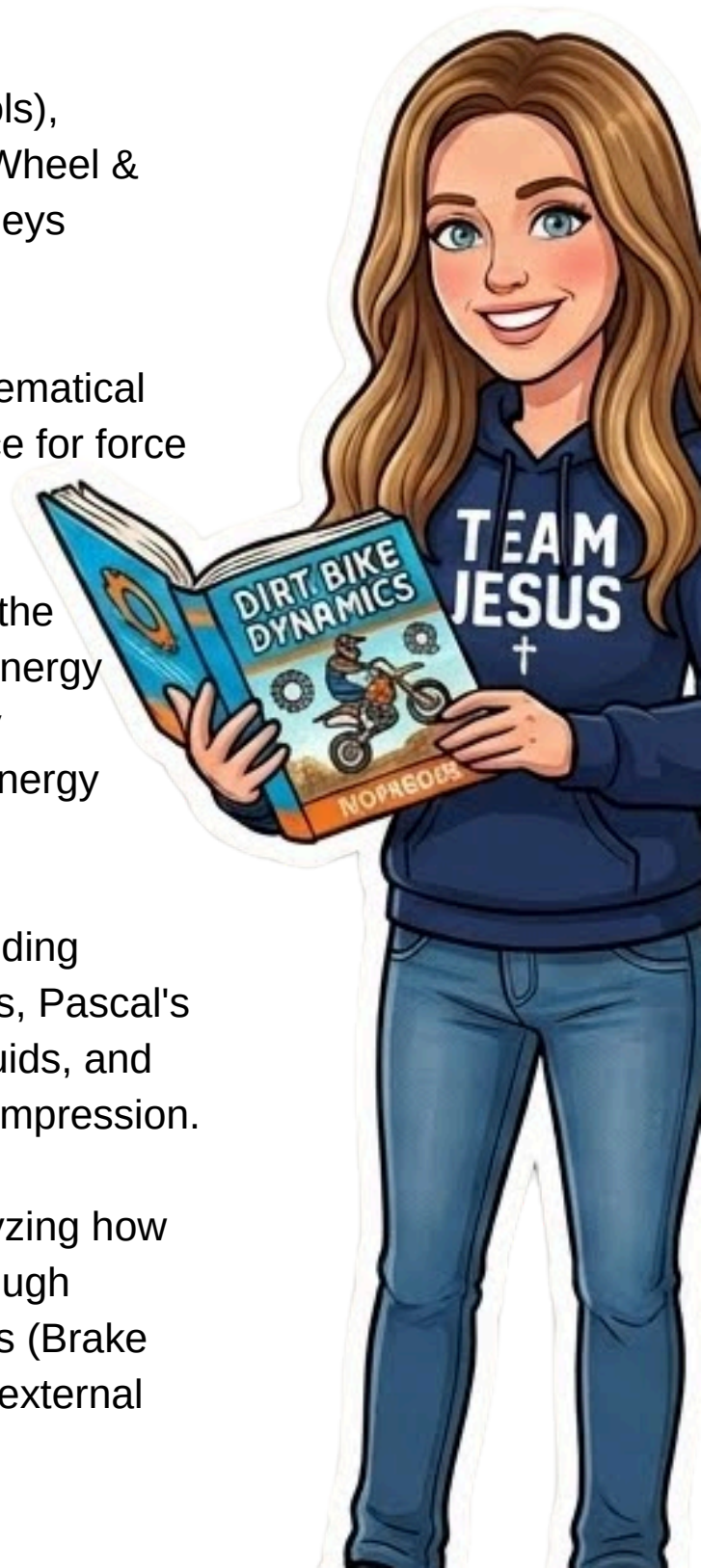


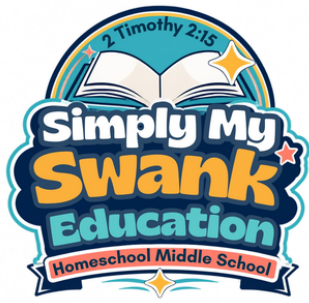
The Academic Framework

(STEM Standards Covered)

The workbook comprehensively covers the essential physical science benchmarks required for middle school education, including:

- **Simple Machines & Forces:** Deep exploration of Levers (Brake Controls), Inclined Planes (Loading Ramps), Wheel & Axle (Handlebars & Hubs), and Pulleys (Throttle Cables & Shop Hoists).
- **Mechanical Advantage:** The mathematical and physical laws of trading distance for force to maximize output strength.
- **Energy Transformations:** Tracing the conservation of energy as Kinetic Energy converts to Elastic Potential Energy (Suspension Springs) or Thermal Energy (Brake Pad Friction).
- **Fluid & Gas Dynamics:** Understanding Pressure Formulas via tire footprints, Pascal's Principle through hydraulic brake fluids, and Gas Laws during internal engine compression.
- **Wave & System Mechanics:** Analyzing how vibrational wave energy travels through mediums and how Floating Systems (Brake Calipers/Rotors) isolate or balance external forces.





The Core Focus:

A Moral & Biblical Foundation

While the science builds the mind, the scriptural integration builds the student. The unique heartbeat of Dirt Bike Dynamics is that mechanical engineering is used as an analogy for character development and spiritual maturity.

Every single day features a custom scripture passage tailored specifically to the challenges, peer pressures, and growth milestones of middle school students.

- **Teamwork & Community:** Learning how gears must mesh and work together reflects how an individual functions as a vital part of a family, church, or community (Romans 12:4-5).
- **Diligence & Maintenance:** Comparing the regular cleaning and oiling of a drive chain to guarding one's heart against negative cultural influences (Proverbs 4:23).
- **Resilience & Grace:** Discovering how heavy-duty steel springs store energy to bounce back from hard drops, showing how placing hope in God allows students to bounce back from life's toughest ruts (Isaiah 40:31).
- **Endurance Over Winning:** Reinforcing that true victory isn't standing on a podium—it's keeping your composure, running your specific race with absolute integrity, and keeping Jesus as your #1 focus when chaos strikes (Hebrews 12:1).





Workbook Style & Layout Optimization:

To maximize classroom engagement, the textbook is structured as a Student Lab Notebook, featuring a predictable, scannable format:

- **Scripture & Rider Connection:** A direct, punchy devotional that sets the moral tone for the day.
- **The Engineering Science:** Concise, active-voice technical breakdowns using simple, non-native accessible language.
- **Workbook Challenges:** Active learning prompts including blueprint labeling, math calculations, and critical thinking essay questions.
- **Independent Answer Key:** A separate teacher/student section that reinforces learning transparency without giving away the answers up front.

The Ultimate Takeaway:

Dirt Bike Dynamics proves that you don't have to separate rigorous academic excellence from a strong moral backbone.

It shows students that the God who created the beautifully orderly laws of physics & engineering is the exact same God who secures their steps on and off the track.

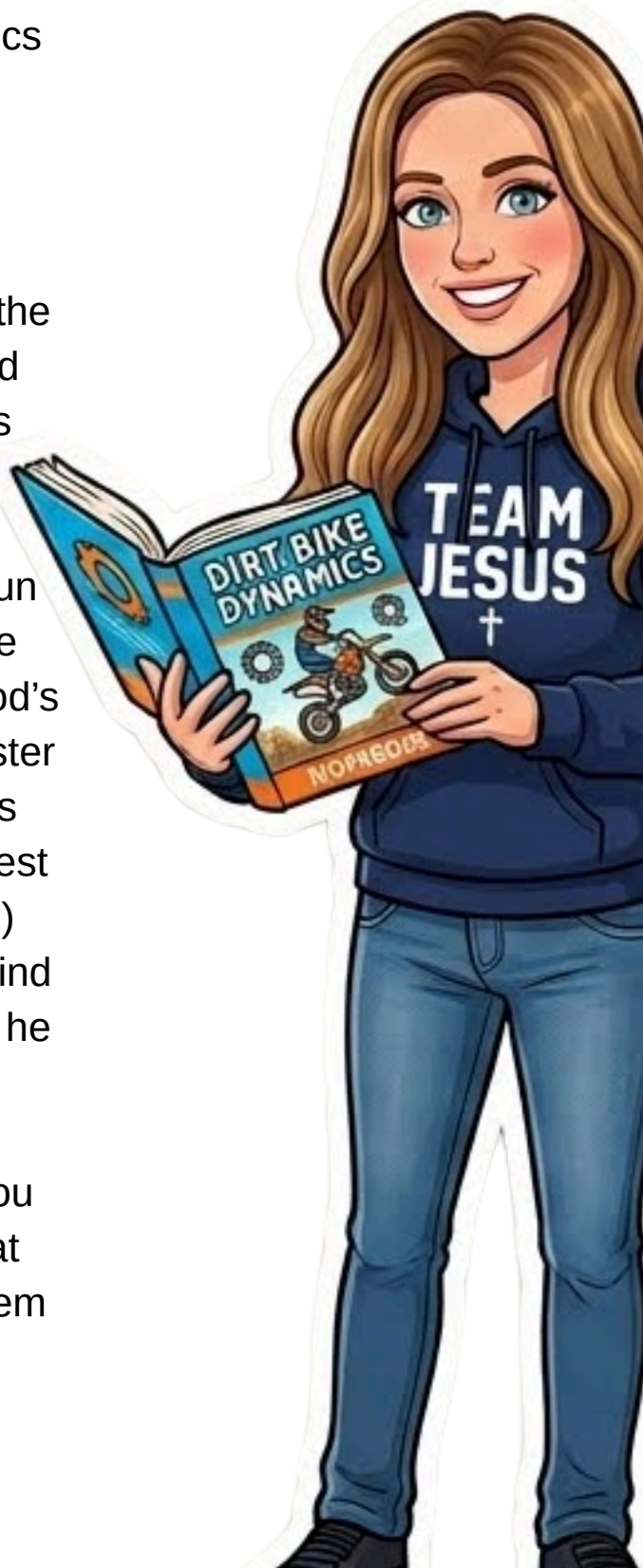




Learning is Fun!

The Game within the Workbook

- The little comics you read along your journey through your Dirt Bike Dynamics Workbook are intended to give you a deeper understanding of what you are reading, but they are created by the computer and they are all very silly.
- See if you can find all the mistakes in the comic strips and circle them, at the end of each day, count how many mistakes you see in each comic and write the number at the bottom of the page.
- Learning is so fun and its even more fun when we get to laugh and be silly while we grow to understand more about God's Creation all around us. God is the master and designer of all science and it is His love language to us. We are His greatest creation! (Genesis 1:27 & Psalm 8:4-5)
- **Genesis 1:27:** "So God created mankind in his own image, in the image of God he created them; male and female he created them."
- **Psalm 8:4-5:** "What is mankind that you are mindful of them, human beings that you care for them? You have made them a little lower than the angels and crowned them with glory and honor."



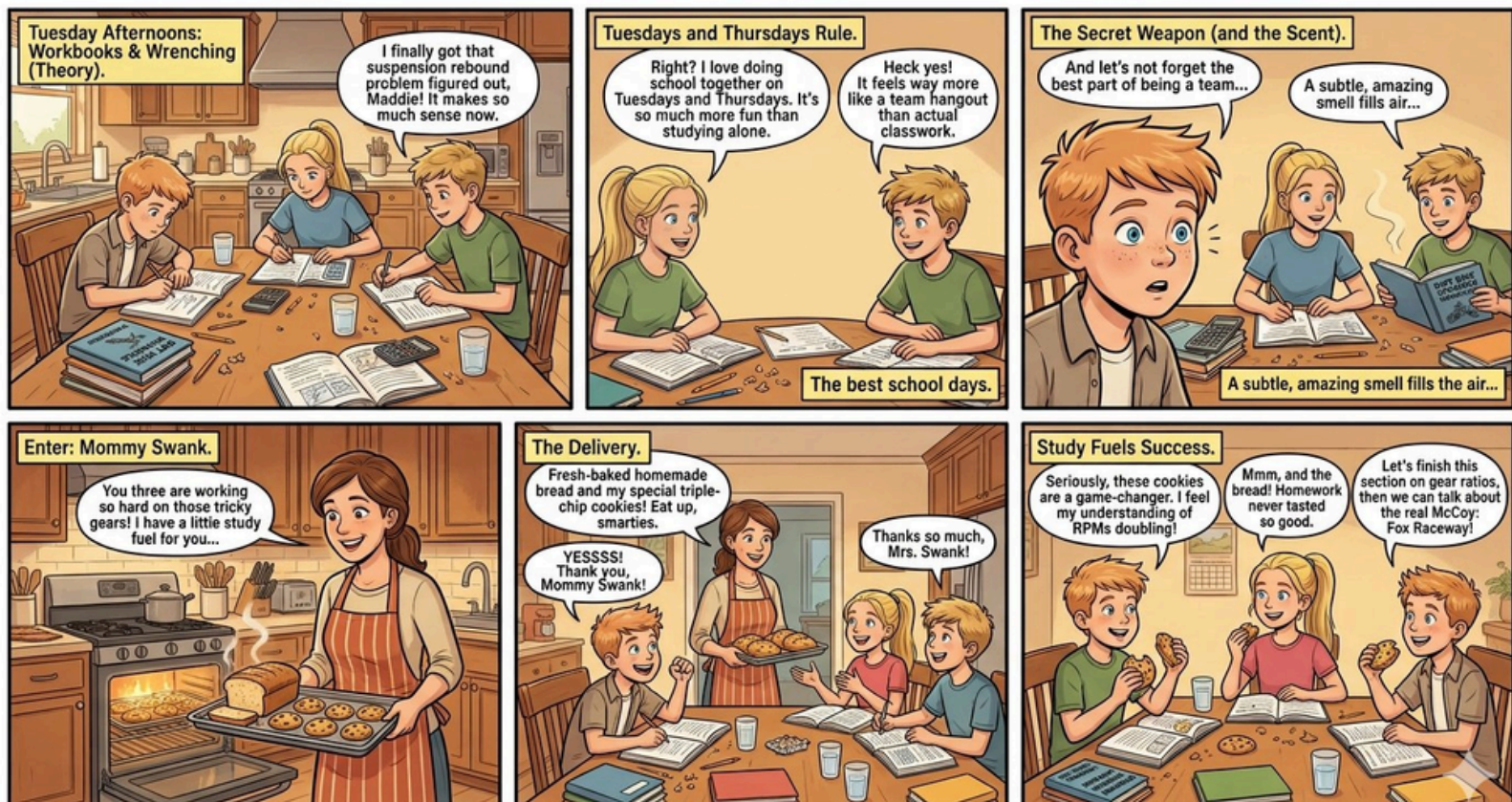


The Joy & Fruit of Homeschooling:

Homeschooling with a foundation of Christian workbooks, moral teaching, and consistent discipline can create a structured, deeply rewarding environment that shapes both a child's intellect and their character.

The Joys of the Journey :

- **Spiritual Alignment:** Parents experience the joy of weaving faith into daily learning, making God a natural part of every subject rather than just a Sunday topic.
- **Academic Clarity:** Structured workbooks offer clear milestones. Celebrating a completed workbook gives children a tangible sense of accomplishment and progress.
- **Family Bond:** Spending your days learning, correcting mistakes, and praying together fosters a unique, lifelong closeness between parents and siblings.
- **Tailored Pace:** You can slow down to master a difficult concept or speed up when your child excels, removing the stress of classroom peer pressure.



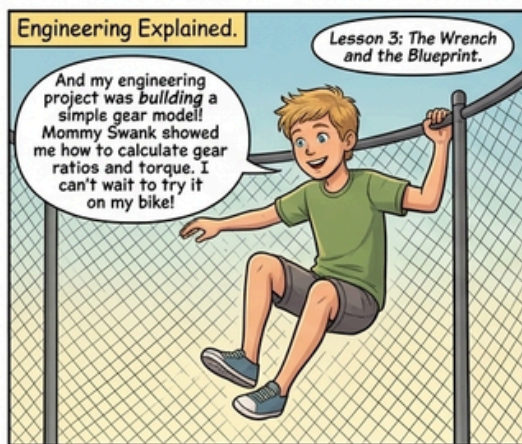
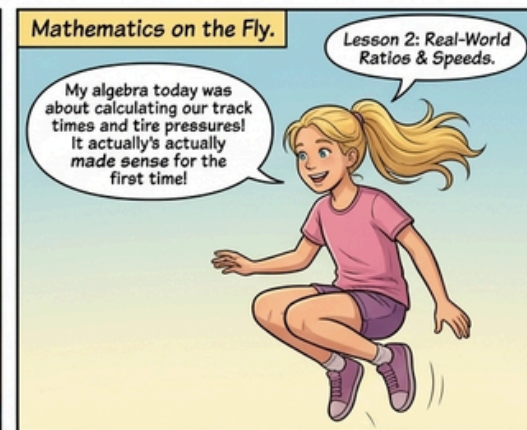
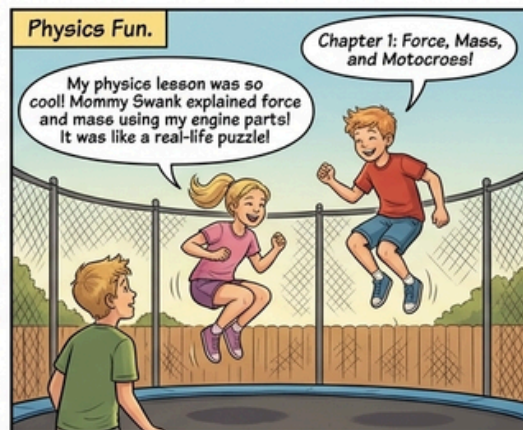
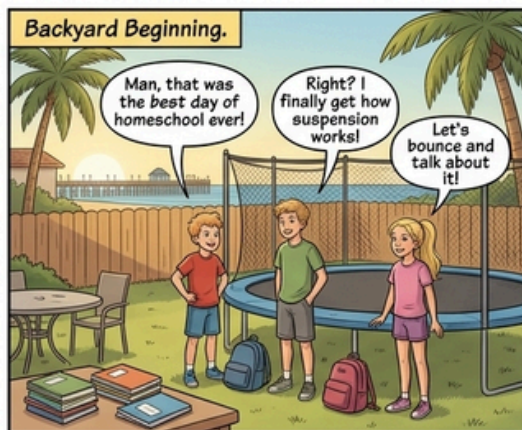


The Joy and Fruit of Homeschooling:

Here is a breakdown of the positive fruits this educational approach can produce:

The Lasting Fruit:

- **A Biblical Worldview:** Using Christian curricula helps children learn to view history, science, and literature through the lens of Scripture, building a firm foundation for their faith.
- **Strong Moral Character:** Prioritizing traits like honesty, kindness, and respect creates a household culture of integrity. Children learn to do the right thing even when no one is watching.
- **Self-Discipline and Responsibility:** Workbook-based learning teaches children how to manage their time, follow instructions, and complete tasks independently—skills that are vital for higher education and future careers.
- **Respect for Authority:** Consistent, loving discipline at home teaches children the value of boundaries, leading to a healthy respect for God, parents, and community laws.



Main Topics:

Simply The Way Things Work – Mechanics & Movement



Titles:

Levers

Incline Plane

Wheels & Axils

Gears, Chains & Sprockets

Cams & Cranks

Pulleys

Springs & Suspension

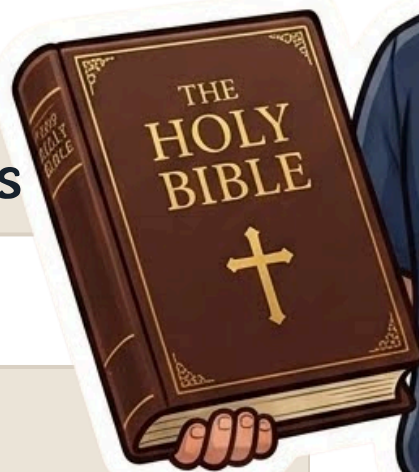
Friction

Pressure

Floating Components in
Mechanical Movement

The Final Test

The Story - The Way Home



LEVERS

Simply The Way Things Work – Mechanics & Movement

Name: _____ Date: _____

Unit: Dirt Bike Dynamics – Mastering Levers

Welcome to your engineering lab notebook. This week, we are looking at the science of dirt bikes. Dirt bikes are incredible machines built for speed, jumps, and rough trails. But beneath all that plastic and metal, a dirt bike is just a collection of simple machines working together.

In this unit, you will learn how engineers use levers to give riders superhuman strength and control.



LEVERS

Simply The Way Things Work – Mechanics & Movement

Name: _____ Date: _____

Day 1: The Anatomy of a Lever and the Brake Control

Daily Scripture Focus

"A wise man has great power, and a man of knowledge increases strength."
— Proverbs 24:5

As a rider or an engineer, brute strength is not enough. True power comes from understanding how things work and using wisdom to guide your actions.

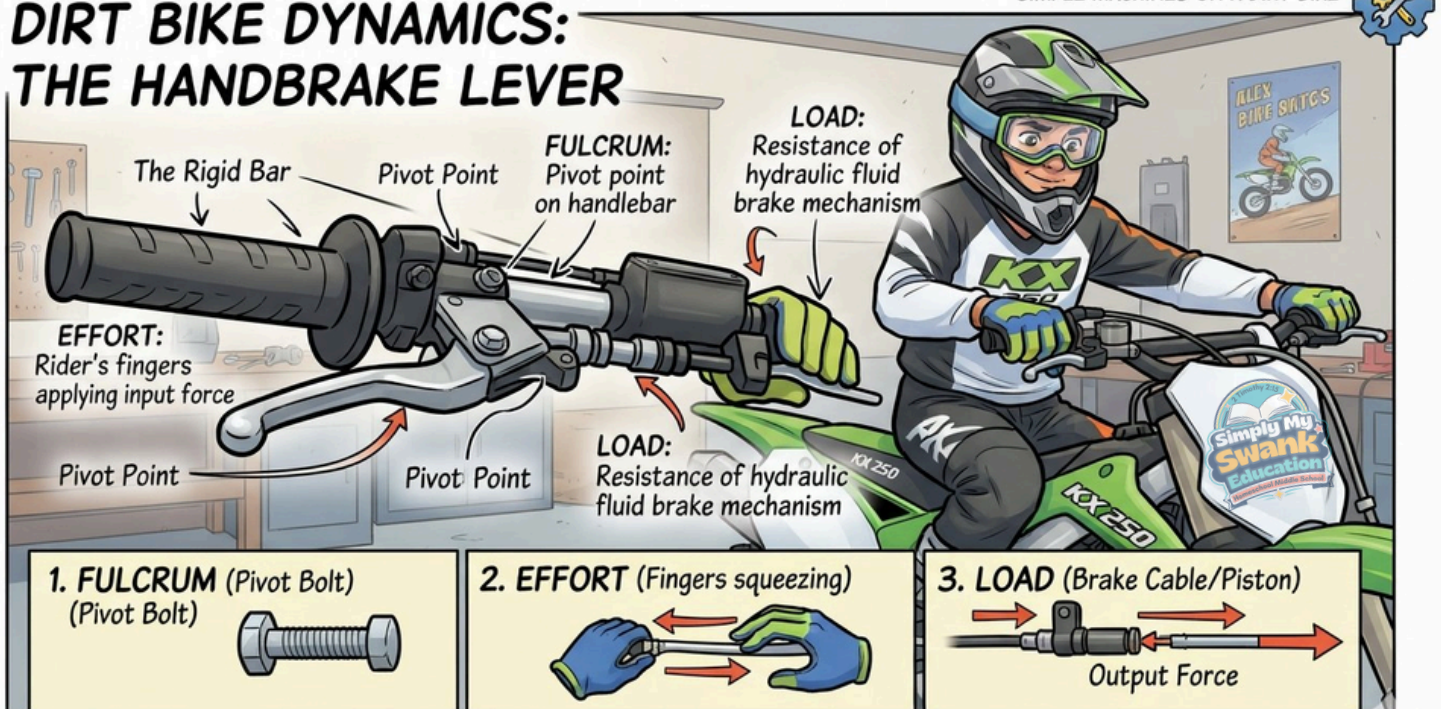
The Engineering Science

A lever is a simple machine made of a rigid bar that turns around a fixed point called a fulcrum. Levers help us move heavy objects or apply large forces with less effort. Every lever has three main parts:

1. **Fulcrum:** The pivot point that does not move.
2. **Effort:** The input force you apply to the lever.
3. **Load (Resistance):** The output force or weight you are trying to move or overcome.

DIRT BIKE DYNAMICS: THE HANDBRAKE LEVER

SIMPLE MACHINES ON A DIRT BIKE



LEVERS

Simply The Way Things Work – Mechanics & Movement

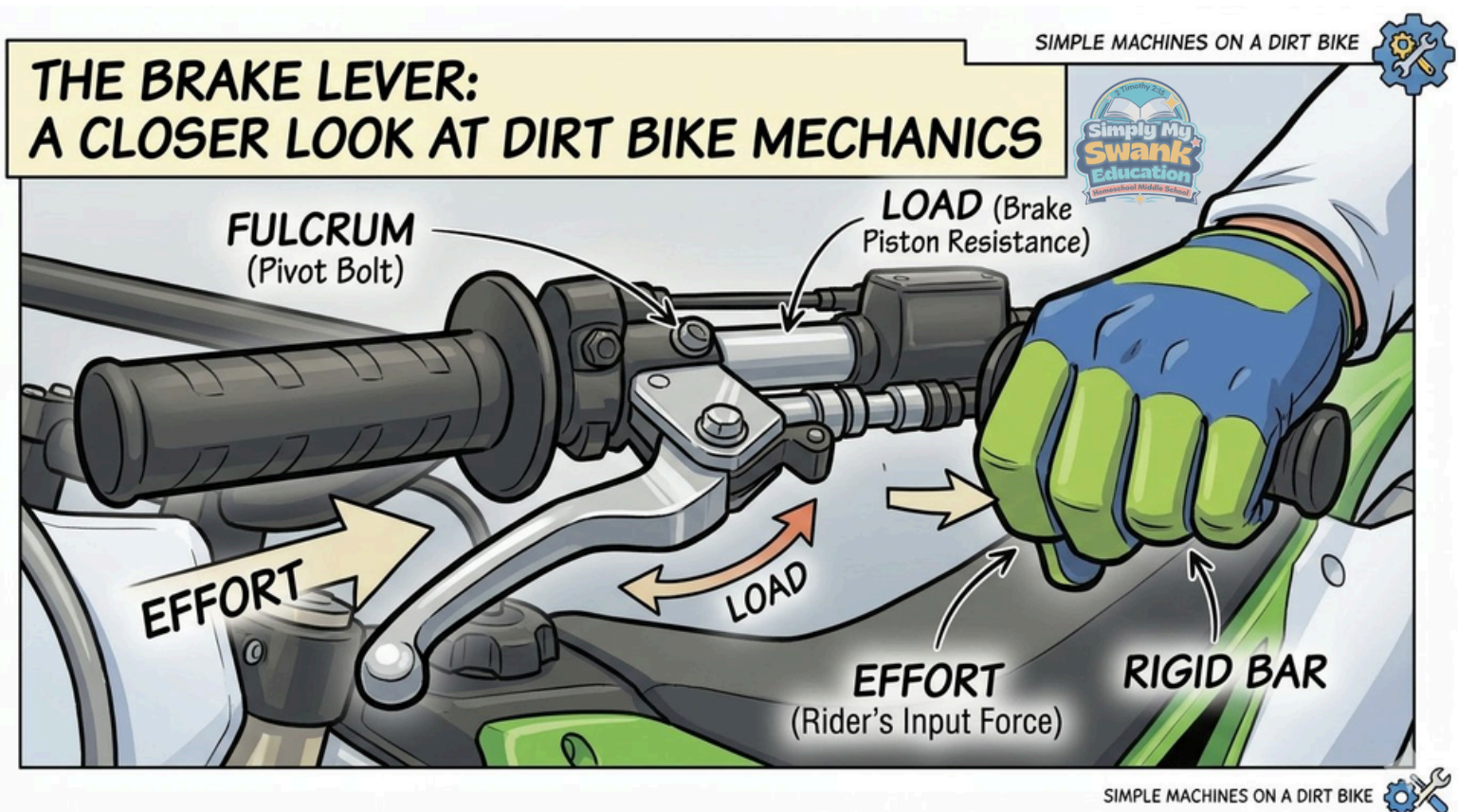
Name: _____ Date: _____

Day 1: The Anatomy of a Lever and the Brake Control

When you sit on a dirt bike, your hands rest right next to two critical levers: the front brake lever and the clutch lever.

Let's look closely at the front brake lever. The pivot bolt holding the lever to the handlebars is the fulcrum. Your fingers pull on the outside end of the lever, applying the effort. In between your fingers and the bolt, a metal plunger connects to the hydraulic braking system. This plunger is the load because it resists your pull.

Levers are divided into three classes based entirely on what sits in the middle. It is called a second-class lever because the Load is located in the middle, sitting directly between the Fulcrum and the Effort.



LEVERS

Simply The Way Things Work – Mechanics & Movement

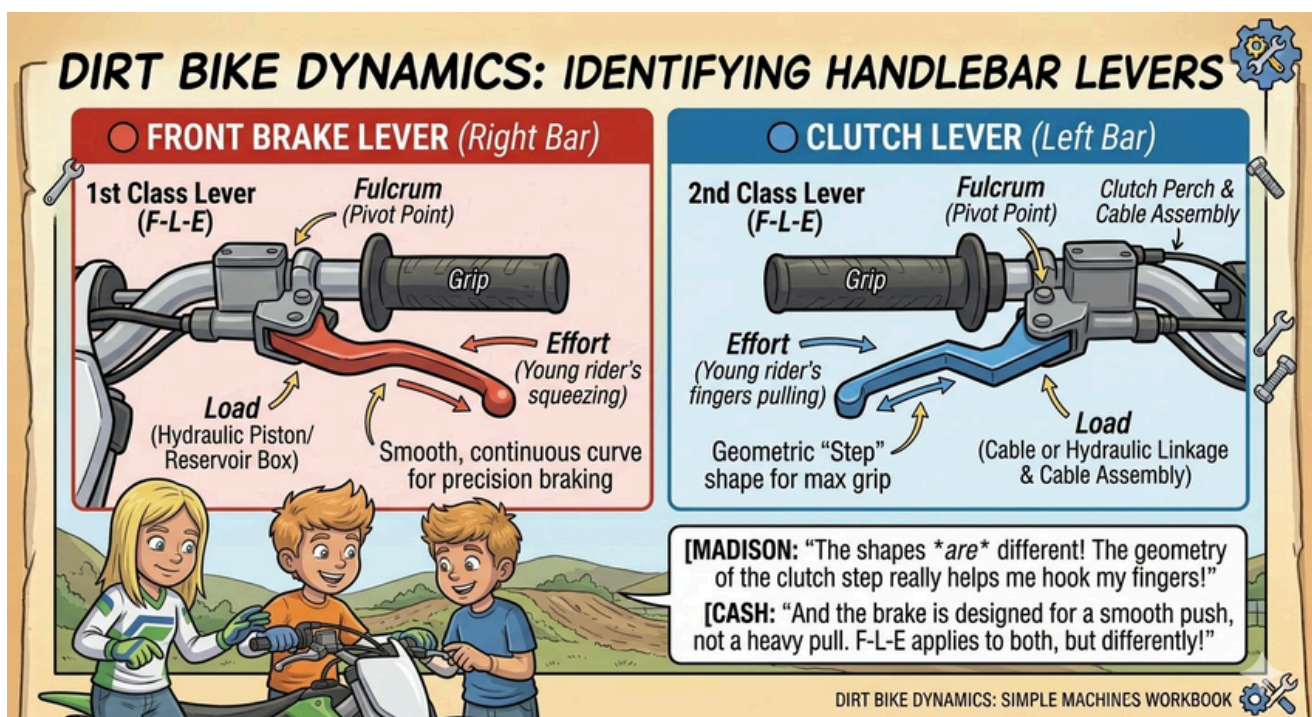
Name: _____ Date: _____

Day 1: The Anatomy of a Lever and the Brake Control

The brake lever and the clutch lever look distinctly different on a dirt bike, primarily because they connect to completely different mechanical systems. While aftermarket pairs are often color-matched to look sleek on the handlebars, their actual shape, mounting architecture, and ergonomic curves vary significantly to handle their specific jobs.

Why the Shapes Vary for Riders

- The Brake Curve: The smooth curve on the right allows your hand to apply varying degrees of leverage. Its profile ensures your fingers can seamlessly hook around the blade to modulate stopping pressure without slipping.
- The Clutch Step: The sudden drop or "shoulder" shape on the left-side clutch lever brings the metal blade closer to the grip. This is intentionally engineered so your index and middle fingers can get maximum hook strength to hold the heavy spring tension of the clutch package while keeping your other fingers safely wrapped around the handlebar grip.



LEVERS

Simply The Way Things Work – Mechanics & Movement

Name: _____ Date: _____

Day 1: The Anatomy of a Lever and the Brake Control

The Mechanical Advantage

Because a second-class lever always places the effort farther from the pivot point than the load, it acts as a force multiplier. This design allows a rider to use a relatively small squeeze of their fingers (Effort) to generate immense mechanical force in the middle (Load), pushing high-pressure hydraulic fluid down the line to clamp the spinning brake rotors tight.

An easy acronym for you to memorize this order is **F-L-E**:

- **1st Class:** Fulcrum is in the middle.
- **2nd Class:** Load is in the middle.
- **3rd Class:** Effort is in the middle

DIRT BIKE DYNAMICS: SIMPLE MACHINES - THE LEVER

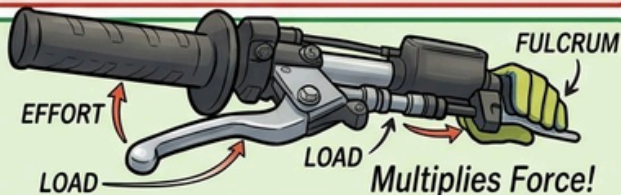
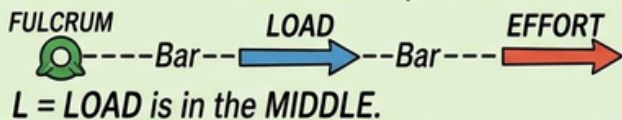
MIDDLE SCHOOL SCIENCE WORKBOOK

EASY ACRONYM: F-L-E

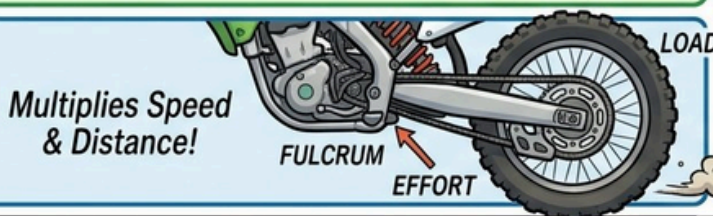
1. FIRST-CLASS LEVER (Fulcrum in the Middle)



2. SECOND-CLASS LEVER (Load in the Middle)



3. THIRD-CLASS LEVER (Effort in the Middle)



LEVERS

Simply The Way Things Work – Mechanics & Movement

Name: _____ Date: _____

Day 1: The Anatomy of a Lever and the Brake Control Why They Are Classified

1. First-Class Levers (Fulcrum in the Middle)

- The Rule: The Fulcrum sits squarely between the Effort and the Load.
- Why it works: When you push down on one side, the opposite side moves up. It reverses the direction of the force.
- Real-World Examples: A playground seesaw, scissors, or a crowbar.
- Dirt Bike Example: A double-sided foot shifter pedal where you stomp on the back peg to pivot the front assembly upward.

2. Second-Class Levers (Load in the Middle)

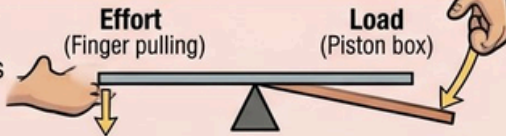
- The Rule: The Load sits between the Fulcrum and the Effort.
- Why it works: Because the Effort is further away from the pivot point than the Load, it acts as a force multiplier. You apply less effort to move a heavy load.
- Real-World Examples: A wheelbarrow or a nutcracker.
- Dirt Bike Example: The handbrake or clutch lever! The pivot bolt is the Fulcrum at one end, your fingers squeeze the outer edge (Effort), and the piston/cable (Load) is pulled right in the center.

DIRT BIKE DYNAMICS: THE 3 CLASSES OF LEVERS!

CLASS 1 LEVER (Fulcrum in Middle)

Rule: F-L-E

EFFORT is magnified as you push **AWAY** from the **FULCRUM**!



CLASS 2 LEVER (Load in Middle)

Rule: F-L-E

EFFORT is easy because the **LOAD** is very close to the **FULCRUM**!



CLASS 3 LEVER (Effort in Middle)

Rule: F-L-E

Great for **RANGE** of motion! The **LOAD** moves farther than the **EFFORT**!



[MADISON: "Wow! Simple machines are everywhere, from the playground to the track!"]
[CASH: "Exactly! Understanding them makes you a better rider and tuner!"]

LEVERS

Simply The Way Things Work – Mechanics & Movement

Name: _____ Date: _____

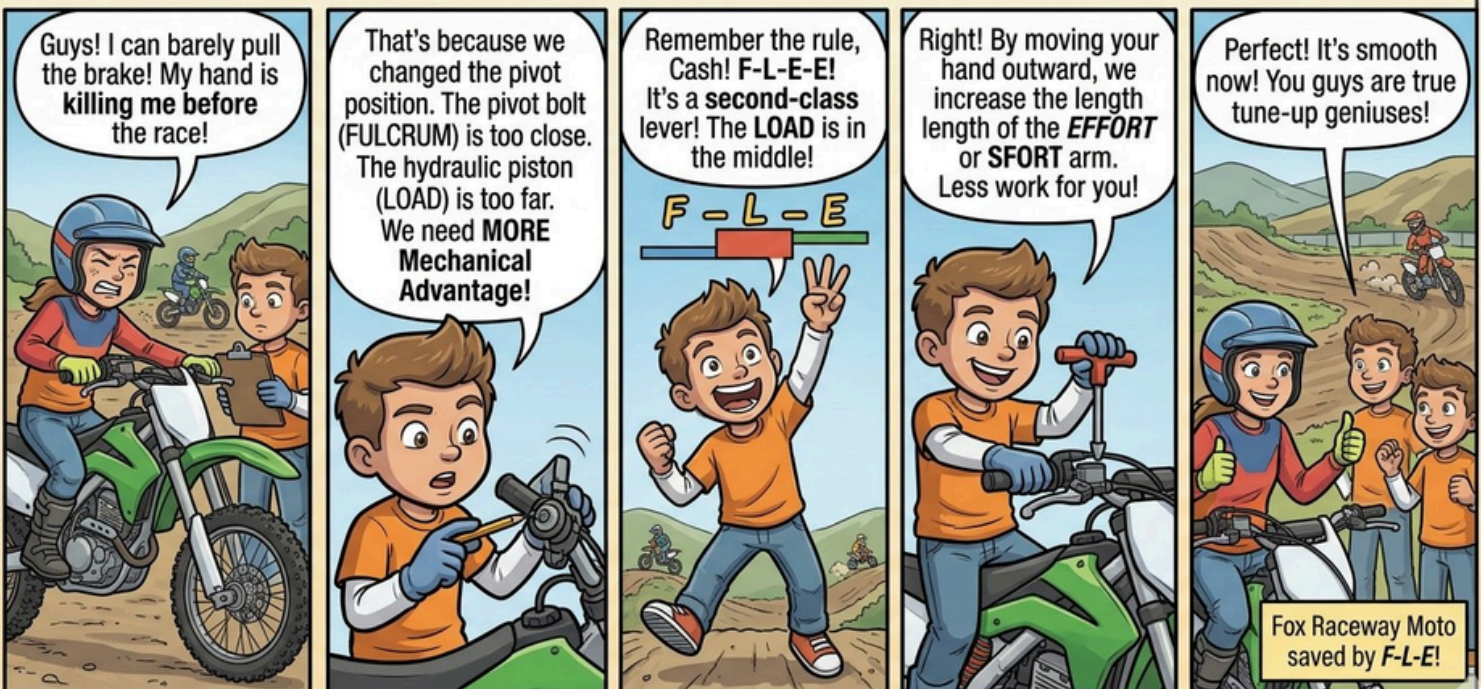
Day 1: The Anatomy of a Lever and the Brake Control

Why They Are Classified

3. Third-Class Levers (Effort in the Middle)

- The Rule: The Effort is applied right between the Fulcrum and the Load.
- Why it works: This class does not multiply force; instead, it is a speed and distance multiplier. Moving the effort a tiny bit in the center swings the far end (the load) across a massive distance very quickly.
- Real-World Examples: A fishing rod, a baseball bat, or tweezers.
- Dirt Bike Example: The rear swingarm suspension. The swingarm pivots at the bike frame (Fulcrum), the rear shock absorber pushes near the middle (Effort), and the rear wheel sits at the very end of the arm (Load)

DIRT BIKE DYNAMICS: THE PIT CREW PUZZLE.



Guys! I can barely pull the brake! My hand is killing me before the race!

That's because we changed the pivot position. The pivot bolt (FULCRUM) is too close. The hydraulic piston (LOAD) is too far. We need **MORE Mechanical Advantage!**

Remember the rule, Cash! **F-L-E-E!** It's a **second-class** lever! The **LOAD** is in the middle!

Right! By moving your hand outward, we increase the length length of the **EFFORT** or **SFORT** arm. Less work for you!

Perfect! It's smooth now! You guys are true tune-up geniuses!

Fox Raceway Moto saved by **F-L-E!**

LEVERS



Simply The Way Things Work – Mechanics & Movement

Name: _____ Date: _____

Day 1: The Anatomy of a Lever and the Brake Control

As we are learning in **Dirt Bike Dynamics**, raw, brute force is completely useless without mechanical intelligence—true speed is achieved only when physics and wisdom guide your actions. If a rider relies solely on muscle power, or if an engineer simply builds a bigger, heavier engine, the dirt bike will become an unrideable, dangerous machine. High-performance racing proves that the strongest rider rarely wins; the wisest rider does.

Workbook Challenges

Identify the Components: In the space below, label where the Fulcrum, Effort, and Load are located on a standard handlebar brake lever.

Pivot Bolt = _____

Hand Grip Area = _____

Brake Fluid Plunger = _____

Critical Thinking: Why do dirt bike riders pull the brake lever at the very edge of the handlebar instead of close to the pivot bolt?

a. Use the word "effort" in your answer.

LEVERS



Simply The Way Things Work – Mechanics & Movement

Name: _____ Date: _____

Day 1: The Anatomy of a Lever and the Brake Control

PART 1: Fill in the Blank Use the words below to complete each statement about dirt bike mechanics.

Word Bank: Fulcrum | Effort | Load | Rigid Bar | Second | Third

1. Every lever setup requires a solid, moving beam structure known as the _____.

2. On a dirt bike handlebar assembly, the pivot bolt acts perfectly as the stationary _____.

3. When a rider uses their fingers to pull the handbrake blade, they are directly applying the _____.

4. The high-pressure resistance generated by a brake fluid piston or mechanical cable represents the lever's _____.

5. Because its hydraulic or mechanical cylinder connection sits squarely in the middle, a front brake assembly belongs to the _____ class of levers.

6. A rear swingarm frame assembly acts as a _____ class lever because its central shock linkage inputs force directly between the pivot mount and the rear wheel axis.

LEVERS



Simply The Way Things Work – Mechanics & Movement

Name: _____ Date: _____

Day 1: The Anatomy of a Lever and the Brake Control

PART 2: Short Answers:

1. Explain the acronym F-L-E and describe how it helps you instantly identify which class any simple lever belongs to.

2. Explain why a dirt bike handbrake lever design is considered a force multiplier. How does this specific mechanical advantage assist the rider during an intense race?

LEVERS

Simply The Way Things Work – Mechanics & Movement

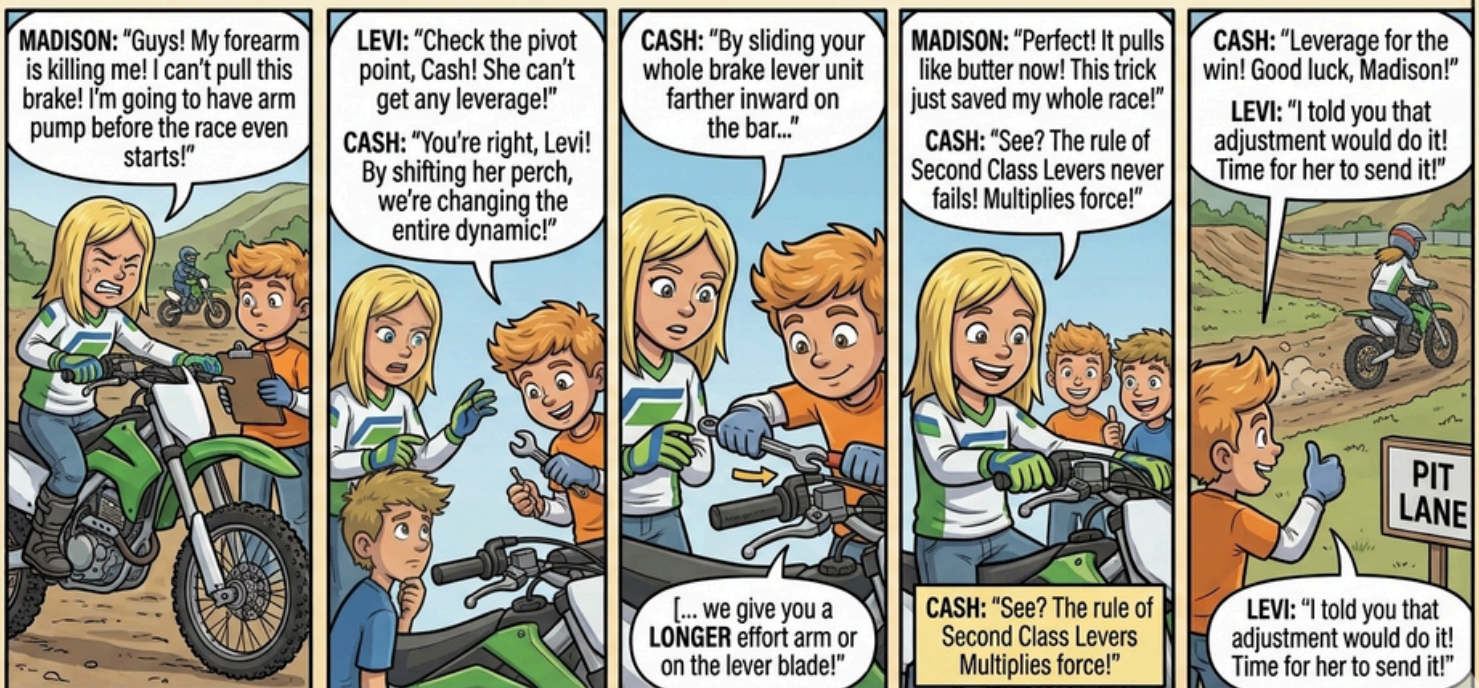
Name: _____ Date: _____

Day 1: The Anatomy of a Lever and the Brake Control

PART 2: Short Answer & Diagram Analysis

3. A dirt bike's rear swingarm suspension acts as a third-class lever, meaning the input effort is located between the pivot point and the rear wheel. Why would engineers use a system that multiplies speed and distance instead of force for a bike's rear wheel suspension setup?

DIRT BIKE DYNAMICS: THE PIT CREW PUZZLE.

MADISON: "Guys! My forearm is killing me! I can't pull this brake! I'm going to have arm pump before the race even starts!"

LEVI: "Check the pivot point, Cash! She can't get any leverage!"

CASH: "You're right, Levi! By shifting her perch, we're changing the entire dynamic!"

CASH: "By sliding your whole brake lever unit farther inward on the bar..."

MADISON: "Perfect! It pulls like butter now! This trick just saved my whole race!"

CASH: "See? The rule of Second Class Levers never fails! Multiplies force!"

CASH: "Leverage for the win! Good luck, Madison!"

LEVI: "I told you that adjustment would do it! Time for her to send it!"

LEVI: "I told you that adjustment would do it! Time for her to send it!"

CASH: "See? The rule of Second Class Levers Multiplies force!"

[... we give you a LONGER effort arm or on the lever blade!]

PIT LANE



LEVERS

Simply The Way Things Work – Mechanics & Movement

Name: _____ Date: _____

