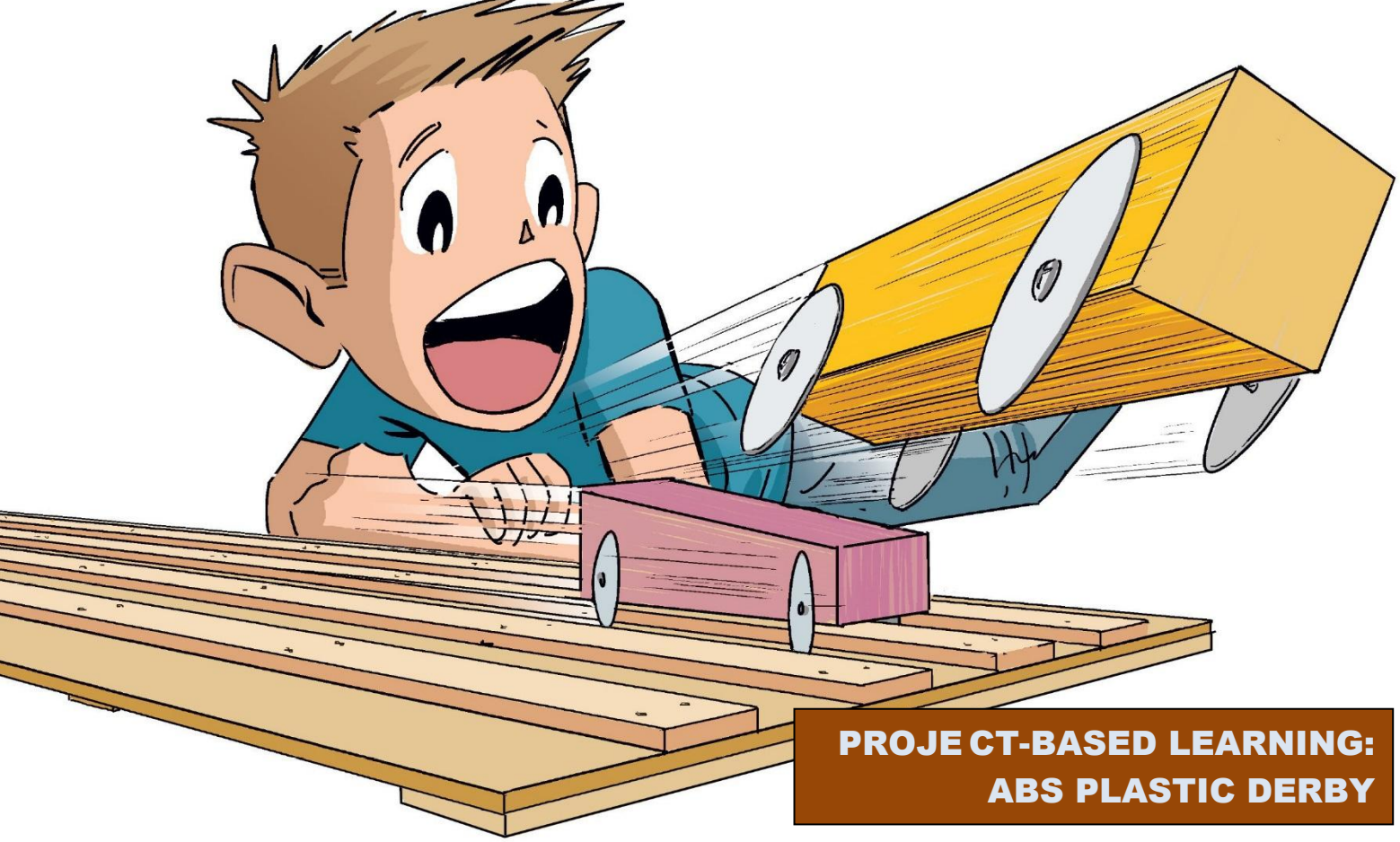


PROJECT-BASED LEARNING: ABS PLASTIC DERBY

Description

Do you remember the pine wood derby cars you designed and built when you were a child? Do you remember how difficult it was to get the shape you wanted in the wood? Did you ever wish there was an easier way to build your car? Now there is!

You will use SolidWorks to design a car that will meet the given **constraints**.

You will see your car come to life in the 3D printer. You will get to make modifications to your car after it is printed – paint, drill holes, add weights, etc.

Finally, we will race your cars to see who the CAD derby champion is!

Deliverables

- Pre-Lesson Work: Anticipatory Guide
- Preliminary Work: Sketches
- Post-Design Work: Costing
- Post-Design Work: CAD Portfolio Page
- Post-Design Work: Speed Math
- Post-Design Work: Your car (Race!)

Requirements

Ideal submissions will meet the following requirements:

1. You must complete all required work for the project by the due dates in order to participate in the races.

2. Your car must adhere to all constraints as detailed in the handouts.

3. Your work must be neat and organized with approvals from your instructor as needed

4. Meet the due dates – If you do not submit by the due date, your car will not be made, you will not participate in the races and you will receive a failing grade for the project.

Anticipation Guide: ABS Derby

Directions: Using only a writing utensil and this handout, please answer the following questions prior to participating in the ABS Derby Project Lesson. Complete the column on the left only. After the lesson, you will be asked to complete the column on the right.

Before Lesson Agree / Disagree	Statement	After Lesson True / False
1.	Potential energy is energy stored in an object.	
2.	Kinetic energy is the energy of mass.	
3.	Speed can be gained through added friction.	
4.	Center of mass is always the center of an object.	
5.	Aerodynamics in design will reduce friction.	
6.	Gravity is a force that is constant.	
7.	Momentum and acceleration are exactly the same	
8.	Acceleration is a vehicle's capacity to gain speed within a short amount of time.	
9.	Mass is the measure of an object's resistance to acceleration when no force is applied.	
10.	Velocity is the speed of an object traveling in a given direction.	
11.	Friction causes heat and will slow an object down.	
12.	Aerodynamics involves an object pushing air molecules out of the way.	

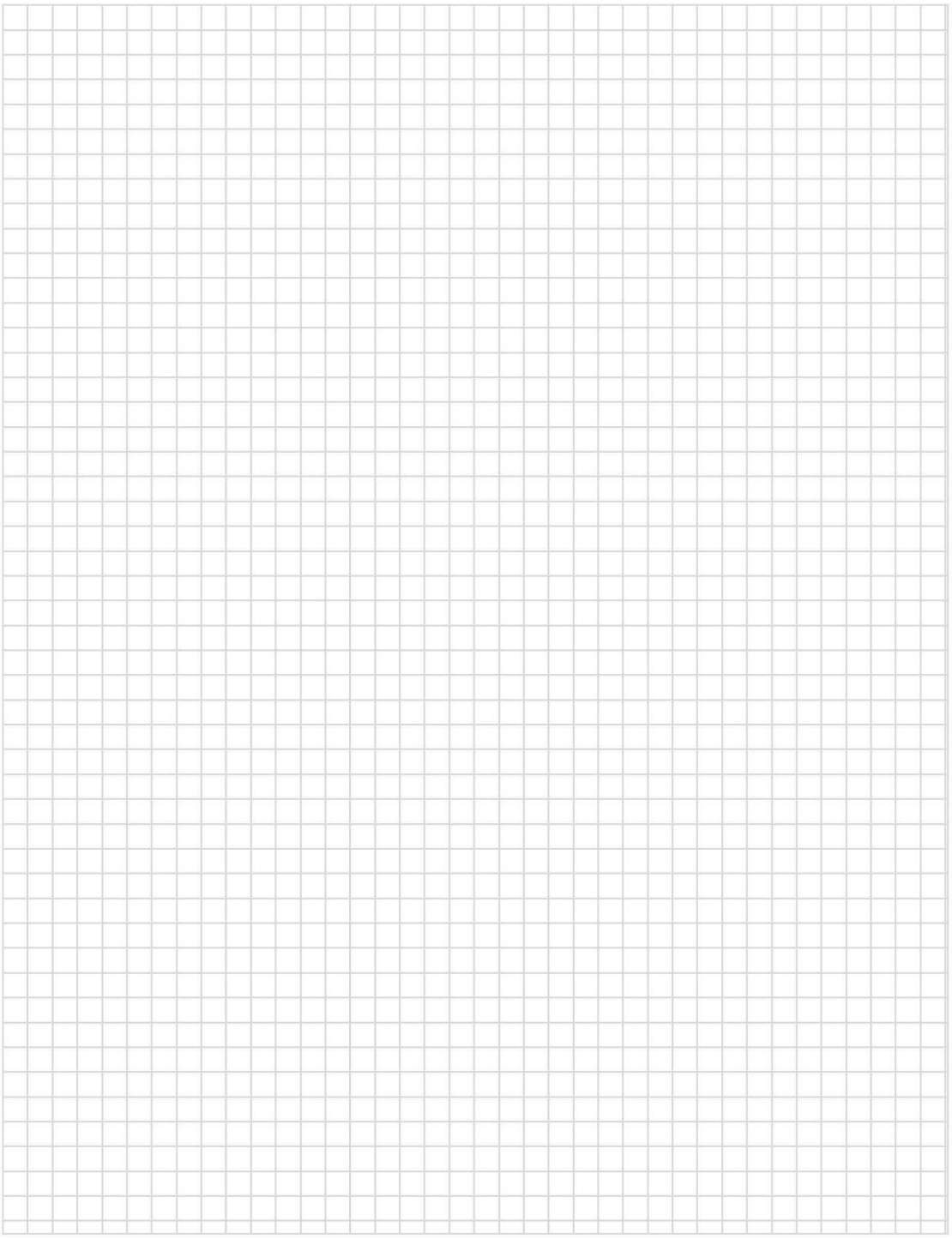
Name:
Date:
Block:

Preliminary Work: Sketches

Directions: Using the space below, sketch a top and side view of your vehicle to scale

NOTE: Each box = 4mm

Top View



Side View

Name:

Date:

Block: **Teacher Signature:** _____

Project Constraints

Note: Your ABS Plastic Derby car *MUST* adhere to the following constraints in order to be race eligible.

- **Material:** ABS Plastic (this is what the 3D printer uses)
- **Units:** Must be designed in metric (mm)
- **Dimensions:**
    - **Width** – Overall width shall not exceed 70mm
    - **Height** – Overall height shall not exceed 55mm
    - **Length** – Overall length shall not exceed 160mm
- **Inside Wheel Base Clearance:** 45mm
- **Ground Clearance:** 10mm
- **Holes for axle:** 2.3mm
- **Wheels:** To be provided by your instructor
- **Axles:** To be provided by your instructor
- **Lubricants:** Graphite only (provided by instructor)
- **Fine Details:** ALL vehicles must be painted and must have a number on each side and on the top
- **Weight:**
    - All vehicles will weigh the same at race time: ***5 ounces total***
    - Weights will be added to all vehicles as needed
    - Be sure to design a place for weights on the bottom or top of your vehicle
        - Suggested weight compartment size:
            - 27mm wide x 50mm long x 20mm deep

Post-Design Work: Costing

Directions: Work individually with Mr. Mandl to determine the approximate cost of your vehicle

Budget: Unlimited

Component	Approximate Cost
Axles (4)	$_____
Wheels (4)	$_____
Chassis (ABS Plus Plastic)	$_____
Chassis (Support Material)	$_____
Lubricant (Graphite)	$_____
Paint	$_____

Approximate Vehicle Cost $_____

Name:

Date:

Block:

Teacher Signature: _____

MATH SKILLS
Addition
Subtraction
Multiplication
Division
Averages
Decimals
Percentages

Post-Design Work: Speed Math

Directions: Using your vehicle, determine the answers to the Following Math equations

1. Run your car down the track and record each time in the "Time (s) column in the table below.

Trial	Time (s)	Average speed (in/s)
1		
2		
3		

2. Complete the third column of the chart, and show your work below.

Trial 1 Work: _____

Trial 2 Work: _____

Trial 3 Work: _____

3. What was the overall average speed of your car? _____

4. If you could increase your car's overall average speed by 10%, what would your car's new overall average speed be? _____

5. If your car travels at an average speed of 30 in/s, what percentage increase or decrease does that represent from your answer to question #3? _____

Name:

Date:

Block:

Teacher Signature: _____

Project Rubric

Points →	20	15	10	5	0	
Anticipatory Guide	------	------	Anticipatory guide is 100% complete.	------	Anticipatory guide is not 100% complete or is missing	____
Sketches	Completed Sketch sheet is turned in with teacher signature.	Completed Sketch sheet is turned in with teacher signature but sketches are not drawn to scale	Sketches are not drawing to scale and/or one sketch is missing and/or teacher signature is missing	Sketch sheet was completed, but with minimal effort.	Sketch form is missing or was not attempted.	
3D Design & Design Constraints	3D design is 100% complete and has been approved by the teacher	3D design is complete, but does not adhere to one or two constraints	3D design is complete, but does not adhere to three or four constraints	3D design is complete, but does not adhere more than four constraints	3D design is missing or was not attempted	____
Costing	------	Costing sheet is complete and signed by teacher	Costing sheet is completed but not signed by teacher	Costing sheet is incomplete and not signed by teacher	Costing Sheet is missing or was not attempted	____
Speed Math	Completed Speed Math sheet is turned in with teacher signature.	Completed Speed Math sheet is turned in without teacher signature.	------	Partially completed Speed Math sheet is turned in without teacher signature.	Speed Math sheet is missing or was not attempted	____
Race Participation	------	Student Participated in the races	------	------	Student did not participate in the races	____
Non-Negotiable Assessment: 50 Points Due date and all requirements of the project have been met.				Assmt. Total →	**100 Points** H.W.Total →	____

Teacher Comments:

Name:

Date:

Block:

Teacher Signature: _____