

- Suspension System: Supports the vehicle and absorbs shocks.
- Components: Springs, shock absorbers, struts.

- Piston: Moves up and down in the cylinder.
- Crankshaft: Converts linear motion of pistons into rotational motion.
- Camshaft: Controls the opening and closing of engine valves.
- Valves: Allow air and fuel in and exhaust out.
- Spark Plug: Gintes the air-level mixture in gasoline engines.

Water Pump: Circulates coolant through the engine and radiator.

Thermostat: Regulates engine temperature by controlling coolant flow

Tire Types: All-season, winter, performance.
Tire Pressure: Important for safety and fuel efficiency; check regularly.
Tread Depth: Ensures proper traction; use a tread depth gauge.

Screwdrivers: Used for driving screws (flathead, Phillips).

Pliers: Used for gripping and cutting (needle-nose, slip-joint).

Impact Wrench: Used for loosening/tightening bolts quickly. Grinder: Used for cutting, grinding, and polishing.

ower Tools: - Drill: Used for making holes; can be corded or cordl

Hand Tools:
- Wrenches: Used for tightening/loosening bolts and nuts (e.g., socket, adjustable).

Battery: Stores electrical energy to start the engine and power electrical components.

Alternator: Charges the battery and powers electrical systems when the engine is running.

Starter Motor: Cranks the engine to start have

- Fuel Tank: Stores fuel.
- Fuel Pump: Delivers fuel to the engine.
- Fuel Injector: Sprays fuel into the combustion chamber.

2. Engine Components

3. Fuel System

4. Electrical System

6. Tires and Wheels

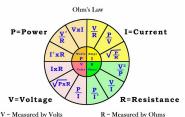
7. Shop Tools and Equipment

Circumference – Distance around a circle

Polygon - A closed shape with straight sides

- Radiator: Cools the engine coolant.

		POLYGONS
Lines 'Lines Horizontal Vertical	thersecting Lines Line of Symmetry Rai	Arcangle Square Squar
Geometry Concept	Formula	Description
Area of a Rectangle	$A = l \times w$	The area is found by multiplying the length and width.
Area of a Triangle	$A=rac{1}{2} imes b imes h$	The area is calculated using the base and height.
Area of a Circle	$A=\pi r^2$	The area of a circle is calculated using the radius.
Circumference of a Circle	$C=2\pi r$ or $C=\pi d$	The circumference is the distance around a circle.
Volume of a Rectangular Prism	$V = l \times w \times h$	The volume is found by multiplying length, width, and height.
Volume of a Cylinder	$V=\pi r^2 h$	The volume of a cylinder is calculated using the radius and height.
Pythagorean Theorem	$a^2 + b^2 = c^2$	Relates the lengths of the sides of a right triangle.
Surface Area of a Sphere	$SA=4\pi r^2$	The surface area is calculated using the radius of the sphere.
Volume of a Sphere	$V=rac{4}{3}\pi r^3$	The volume is calculated using the radius of the sphere.
Sum of Interior Angles of a	$(n-2) imes180^\circ$	The sum of the interior angles of an n -sided polygon.



V - Measured by Volts

I = Measured by Amps

P = Measured by Watt

AC vs. DC
Alternating Current (AC): Current that changes direction periodically (e.g., household electricity)
Direct Current (DC): Current that flows in one direction (e.g., batteries).

Basic Electrical Concepts
Voltage (V): The electrical potential difference between two points. Measured in volts (V).
Current (i): The flow of electric charge. Measured in amperes (A).
Resistance (R): The opposition to the flow of current. Measured in ohms (Ω).

Electrical Units of Measurement Amneres: measures electrical current

Basic Components
Resistors: Limit current flow, measured in ohms.
Capacitors: Store electrical energy, measured in farads.
Inductors: Store energy in a magnetic field; measured in henries.
Diodes: Allow current to flow in one direction only.
Transistors: Used for switching and amplification.

Electrical Safety
Grounding: A safety measure to prevent electric shock.
Fuses and Circuit Breakers: Protect circuits from overload by breaking the circuit when current worders a certain level

Circuit Types
Series Circuits: Components are connected end-to-end; current is the same through all compo

rides.

Yarallel Circuits: Components are connected across the same voltage source; voltage is the same across all mponents, but current divides.

Electrical Measurements
Multimeter: A tool used to measure voltage, current, and res
Oscilloscope: A device used to visualize electrical signals.



3 Gear and Rack A circular gear (pinion) meshe

4. Compound Gear Train

Used to create very large or small gear ratios

6. Worm Gear

Offers high torque and very slow output speed

 $^{\circ}C = (^{\circ}F - 32) \times \frac{5}{9}$

 $^{\circ}C = (68 - 32) \times \frac{5}{2}$

 $^{\circ}C = (36) \times \frac{5}{9} = 20^{\circ}C$

. Spur Gear with Belt or Chain



More gears = slower output speed (if input stays co

Key Rules to Remember

Smaller gear = faster rotation

Larger gear = more torque

1. Celsius to Fahrenheit

Meshed gears alternate direction



2. Fahrenheit to Celsius

 $^{\circ}F = \left(\frac{9}{5} \times ^{\circ}C\right) + 32$ xample: Convert 68° F to Celsius

 $F = \left(\frac{9}{5} \times 25\right) + 32$

 $F = (45) + 32 = 77^{\circ}$

 \square Answer: $68^{\circ}F = 20^{\circ}C$

🌞 Gear Ratio – Example Problem

Gear A has 12 teeth and is driving Gear B, which has 36 teeth.

Step-by-step:

What is the gear ratio, and how many revolutions will Gear A make while Gear B makes 1 full

Solution:

The gear ratio is calculated as:

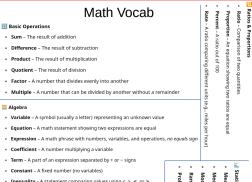
 $\frac{\text{Teeth on Driven Gear}}{\text{Teeth on Driver Gear}} = \frac{36}{12} = 3:1$

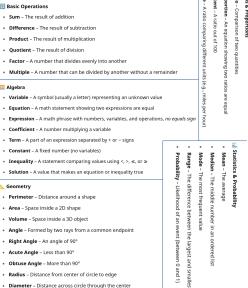
. Gear A must turn 3 times for Gear B to make 1 full revolution

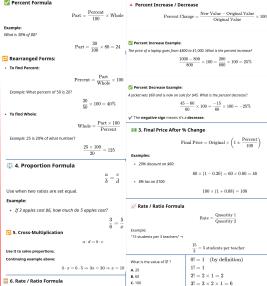
Final Answer:

Gear Ratio = 3:1

Gear A makes 3 revolutions for every 1 revolution of Gear B







 $Rate = \frac{180}{3} = 60 \text{ miles per hor}$

and 1)

Wrench: Tightens or loosens nuts and bolts; available in various types (e.g., adjustable, socket). Hammer: Drives nails into wood or other materials: can also be used for demolition Tape Measure: Measures length or distance; typically flexible and retractable Level: Determines if a surface is horizontal (level) or vertical (plumb). Chisel: Carves or cuts hard materials like wood, stone, or metal, Drill: Creates holes in various materials; can be manual or powered. Saw: Cuts wood or other materials: types include hand saws, circular saws, and iigsaws,

Safety Goggles: Protects eyes from debris, chemicals, or other hazards while working

Tools

Wire Strippers: Removes insulation from electrical wires without damaging the wire

Multimeter: Measures voltage, current, and resistance in electrical circuits

Oscilloscope: Visualizes electrical signals and waveforms over time. Screwdriver: Turns screws; available in various types (e.g., flathead, Phillips) Pliers: Grips, twists, bends, and cuts wire or other materials.

Caliper: Measures the distance between two opposite sides of an object; can measure internal and external dimensions. Soldering Iron: Melts solder to join electrical components together Heat Gun: Applies heat to materials for purposes like shrinking tubing or removing paint. Flashlight: Illuminates dark areas; essential for working in low-light conditions.

Gloves: Protects hands from cuts, abrasions, or chemicals. Crowbar: Pries, lifts, or breaks apart materials. Stud Finder: Locates framing studs behind walls for securely hanging items.

Utility Knife: Cuts through various materials; often retractable for safety. Socket Set: Contains various sizes of sockets for turning nuts and bolts.

Pipe Wrench: Grips and turns pipes and fittings; adjustable for different sizes Nail Gun: Drives nails into wood or other materials quickly and efficiently.

Angle Grinder: Used for cutting, grinding, and polishing metal and other materials Jigsaw: Cuts curves and intricate shapes in wood, metal, or plastic.

Claw Hammer: A hammer with a split end for removing nails. Ruler: A straight tool used for measuring length or drawing straight lines Pry Bar: Used for pulling apart materials or removing nails.

Percent Formula

 $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$

Torpedo Level: A small level used for checking horizontal and vertical surfaces in tight

 $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$ $6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$

 $4! = 4 \times 3 \times 2 \times 1 = 24$