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Jt Scratch Lesson 2 • Summer 2012 • slide 1

Scratch Programming

Lesson 2: Solving a Problem

Problem

1. Figure out how many miles a car with a full tank of gas can travel if you know how big its gas tank is, and you know its gas mileage.

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Problem

2. After asking for the length of a trip the car takes, calculate how much gas is used on the trip, and how much remains in the tank. Calculate how full (percentage) the tank is.

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Problem

3. Display a gas gauge on the screen and have the needle show how much gas is in the car. Add related to filling up a gas tank and sound effects to represent a car trip.

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Part 1 : Variables

GallonsTankHolds

MPG

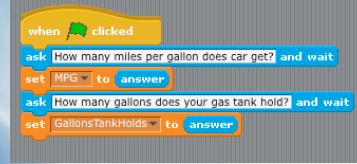
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Part 1 : Start



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Part 1 : Input



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Part 1 : Calculate

- How far can car travel on full tank?

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Part 1 : Calculate

- How far can car travel on full tank?

Pick a variable:

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Part 1 : Calculate

- How far can car travel on full tank?

Pick a variable: PossibleMiles

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Part 1 : Calculate

- How far can car travel on full tank?

Pick a variable: PossibleMiles

Example 1:

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Part 1 : Calculate

- How far can car travel on full tank?

Pick a variable: PossibleMiles

Example 1:

Gas Tank: 10 Gallons

Gas Mileage: 20 mpg

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Part 1 : Calculate

- How far can car travel on full tank?

Pick a variable: PossibleMiles

Example 1:

Gas Tank: 10 Gallons

Gas Mileage: 20 mpg

How many miles can car travel?

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Part 1 : Calculate

- How far can car travel on full tank?

Pick a variable: PossibleMiles

Example 1:

Gas Tank: 10 Gallons

Gas Mileage: 20 mpg

How many miles can car travel? 200

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Part 1 : Calculate

- How far can car travel on full tank?

Pick a variable: PossibleMiles

Example 2:

Gas Tank: 15 Gallons

Gas Mileage: 30 mpg

How many miles can car travel?

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Part 1 : Calculate

- How far can car travel on full tank?

Pick a variable: PossibleMiles

Example 2:

Gas Tank: 15 Gallons

Gas Mileage: 30 mpg

How many miles can car travel? 450

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Part 1 : Calculate

- How far can car travel on full tank?

Pick a variable: PossibleMiles

General Situation:

Gas Tank: GallonsTankHolds

Gas Mileage: MPG

How many miles can car travel? (equation)

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Part 1 : Calculate

- How far can car travel on full tank?

Pick a variable: PossibleMiles

$$\text{PossibleMiles} = \text{GallonsTankHolds} * \text{MPG}$$

General Situation:

Gas Tank: GallonsTankHolds

Gas Mileage: MPG

How many miles can car travel? (equation)

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Part 1 : Calculate

- How far can car travel on full tank?

Pick a variable: PossibleMiles



General Situation:

Gas Tank: GallonsTankHolds

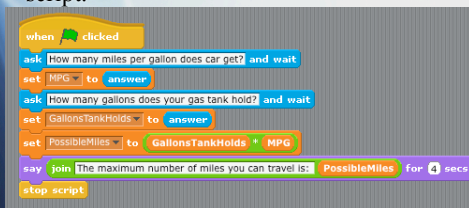
Gas Mileage: MPG

How many miles can car travel? (equation)

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Part 1 : Display Result

- Append calculation to code, say result, end script.

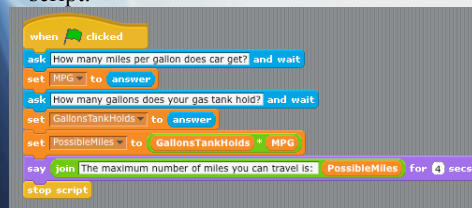


```
when clicked
ask How many miles per gallon does car get? and wait
set MPG to answer
ask How many gallons does your gas tank hold? and wait
set GallonsTankHolds to answer
set PossibleMiles to GallonsTankHolds * MPG
say join The maximum number of miles you can travel is: PossibleMiles for 4 secs
stop script
```

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Part 1 : Display Result

- Append calculation to code, say result, end script.



```
when clicked
ask How many miles per gallon does car get? and wait
set MPG to answer
ask How many gallons does your gas tank hold? and wait
set GallonsTankHolds to answer
set PossibleMiles to GallonsTankHolds * MPG
say join The maximum number of miles you can travel is: PossibleMiles for 4 secs
stop script
```

■ Demo: GasMeter 1

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Part 2

- After asking for the length of a trip the car takes, calculate how much gas is used on the trip, and how much remains in the tank. Calculate how full (percentage) the tank is.

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Part 2 : Variables

- After asking for the length of a trip the car takes, calculate how much gas is used on the trip, and how much remains in the tank. Calculate how full (percentage) the tank is.

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Part 2 : Variables

2. After asking for the length of a trip the car takes, calculate how much gas is used on the trip, and how much remains in the tank. Calculate how full (percentage) the tank is.

TripMiles

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Part 2 : Variables

2. After asking for the length of a trip the car takes, calculate how much gas is used on the trip, and how much remains in the tank. Calculate how full (percentage) the tank is.

TripMiles
GallonsUsed

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Part 2 : Variables

2. After asking for the length of a trip the car takes, calculate how much gas is used on the trip, and how much remains in the tank. Calculate how full (percentage) the tank is.

TripMiles
GallonsUsed
GallonsInCar

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Part 2 : Variables

2. After asking for the length of a trip the car takes, calculate how much gas is used on the trip, and how much remains in the tank. Calculate how full (percentage) the tank is.

TripMiles
GallonsUsed
GallonsInCar
PercentFull

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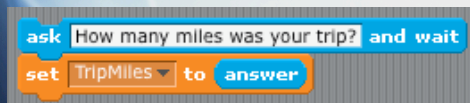
Part 2 : Input

Ask how many miles the car trip was.

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Part 2 : Input

Ask how many miles the car trip was.



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Part 2 : Calculate

How many gallons of gas used? (GallonsUsed)

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Part 2 : Calculate

How many gallons of gas used? (GallonsUsed)

Example 1: Car gets 20 miles per gallon, holds 15 gallons of gas, and took a trip of 60 miles?

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Part 2 : Calculate

How many gallons of gas used? (GallonsUsed)

Example 1: Car gets 20 miles per gallon, holds 15 gallons of gas, and took a trip of 60 miles?

How many gallons were used?

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Part 2 : Calculate

How many gallons of gas used? (GallonsUsed)

Example 1: Car gets 20 miles per gallon, holds 15 gallons of gas, and took a trip of 60 miles?

How many gallons were used? 3

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Part 2 : Calculate

How many gallons of gas used? (GallonsUsed)

Example 2: Car gets 25 miles per gallon, holds 10 gallons of gas, and took a trip of 100 miles?

How many gallons were used?

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Part 2 : Calculate

How many gallons of gas used? (GallonsUsed)

Example 2: Car gets 25 miles per gallon, holds 10 gallons of gas, and took a trip of 100 miles?

How many gallons were used? 4

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Part 2 : Calculate

How many gallons of gas used? (GallonsUsed)

4

Example 2: Car gets 25 miles per gallon, holds 10 gallons of gas, and took a trip of 100 miles?

What values are important to the calculation?

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Part 2 : Calculate

How many gallons of gas used? (GallonsUsed)

4

Example 2: Car gets 25 miles per gallon, holds 10 gallons of gas, and took a trip of 100 miles?

What values are important to the calculation?

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Part 2 : Calculate

How many gallons of gas used? (GallonsUsed)

4

Example 2: Car gets 25 miles per gallon, holds 10 gallons of gas, and took a trip of 100 miles?

Do you remember the variable names?

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Part 2 : Calculate

How many gallons of gas used?

GallonsInCar

GallonsTankHolds

GallonsUsed

MPG

PercentFull

PossibleMiles

TripMiles

4

Example 2: Car gets 25 miles per gallon, holds 10 gallons of gas, and took a trip of 100 miles?

Do you remember the variable names?

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Part 2 : Calculate

How many gallons of gas used? (GallonsUsed)

4

Example 2: Car gets 25 miles per gallon, holds 10 gallons of gas, and took a trip of 100 miles?

Do you remember the variable names?

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Part 2 : Calculate

How many gallons of gas used? (GallonsUsed)

4

Example 2: Car gets 25 miles per gallon, holds 10 gallons of gas, and took a trip of 100 miles?

So what is the general equation?

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Part 2 : Calculate

How many gallons of gas used? (GallonsUsed)

$$\text{GallonsUsed} = \text{TripMiles} / \text{MPG}$$

4

MPG

Example 2: Car gets 25 miles per gallon, holds 10 gallons of gas, and took a trip of 100 miles?
So what is the general equation?

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Part 2 : Calculate & Display

How many gallons of gas used? (GallonsUsed)

```
ask How many miles was your trip? and wait
set TripMiles to answer
set GallonsUsed to TripMiles / MPG
say The amount of gallons of gas you used during the trip is GallonsUsed for 2 secs
say GallonsUsed for 2 secs
```

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Part 2 : Calculate

How many gallons left in tank? (GallonsInCar)

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Part 2 : Calculate

How many gallons left in tank? (GallonsInCar)

- Example: Tank was full and held 15 gallons, and trip used up 3. How many left?

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Part 2 : Calculate

How many gallons left in tank? (GallonsInCar)

- Example: Tank was full and held 15 gallons, and trip used up 3. How many left? 12

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Part 2 : Calculate

How many gallons left in tank? (GallonsInCar)

```
GallonsInCar
GallonsTankHolds
GallonsUsed
MPG
PercentFull
PossibleMiles
TripMiles
```

Variable names?

- Example: Tank was full and held 15 gallons, and trip used up 3. How many left? 12

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Part 2 : Calculate

How many gallons left in tank? (GallonsInCar)

Variable names?

GallonsTankHolds

- Example: Tank was full and held 15 gallons, and trip used up 3. How many left? 12

GallonsUsed

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Part 2 : Calculate

How many gallons left in tank? (GallonsInCar)

Equation?

GallonsTankHolds

- Example: Tank was full and held 15 gallons, and trip used up 3. How many left? 12

GallonsUsed

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Part 2 : Calculate & Display

How many gallons left in tank? (GallonsInCar)

```
set GallonsInCar to GallonsTankHolds - GallonsUsed
say join You now have join GallonsInCar gallons of gas in your car. for 2 secs
```

Equation?

GallonsTankHolds

- Example: Tank was full and held 15 gallons, and trip used up 3. How many left? 12

GallonsUsed

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Part 2 : Calculate

How full is the tank? (PercentFull)

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Part 2 : Calculate & Display

How full is the tank? (PercentFull)

- Example: Tank holds 10 gallons, and has 4 gallons left. How full (percent) is tank?

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Part 2 : Calculate

How full is the tank? (PercentFull)

- Example: Tank holds 10 gallons, and has 4 gallons left. How full (percent) is tank? 40%

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Part 2 : Calculate

How full is the tank? (PercentFull)

GallonsInCar

GallonsTankHolds

GallonsUsed

MPG

PercentFull

PossibleMiles

TripMiles

Variables?

- Example: Tank holds 10 gallons, and has 4 gallons left. How full (percent) is tank? 40%

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Part 2 : Calculate

How full is the tank? (PercentFull)

Variables?

- Example: Tank holds 10 gallons, and has 4 gallons left. How full (percent) is tank? 40%

GallonsTankHolds GallonsInCar
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Part 2 : Calculate

How full is the tank? (PercentFull)

Equation?

- Example: Tank holds 10 gallons, and has 4 gallons left. How full (percent) is tank? 40%

GallonsTankHolds GallonsInCar
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Part 2 : Calculate

How full is the tank? (PercentFull)

PercentFull = GallonsLeft / GallonsInTank

Equation?

- Example: Tank holds 10 gallons, and has 4 gallons left. How full (percent) is tank? 40%

GallonsTankHolds GallonsInCar
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Part 2 : Calculate

How full is the tank? (PercentFull)

PercentFull = GallonsLeft / GallonsInTank

Try It

- Example: Tank holds 10 gallons, and has 4 gallons left. How full (percent) is tank? 40%

GallonsTankHolds GallonsInCar
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Part 2 : Calculate

How full is the tank? (PercentFull)

PercentFull = GallonsLeft / GallonsInTank

4 / 10 =

Try It

- Example: Tank holds 10 gallons, and has 4 gallons left. How full (percent) is tank? 40%

GallonsTankHolds GallonsInCar
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Part 2 : Calculate

How full is the tank? (PercentFull)

$$\text{PercentFull} = \text{GallonsLeft} / \text{GallonsInTank}$$
$$4 / 10 = .4$$

Try It

- Example: Tank holds 10 gallons, and has 4 gallons left. How full (percent) is tank? 40%

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Part 2 : Calculate

How full is the tank? (PercentFull)

$$\text{PercentFull} = \text{GallonsLeft} / \text{GallonsInTank}$$
$$4 / 10 = .4 \quad \text{Not 40!}$$

Try It

- Example: Tank holds 10 gallons, and has 4 gallons left. How full (percent) is tank? 40%

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Part 2 : Calculate

How full is the tank? (PercentFull)

$$\text{PercentFull} = (\text{GallonsLeft} / \text{GallonsInTank})$$

So multiply result by 100

- Example: Tank holds 10 gallons, and has 4 gallons left. How full (percent) is tank? 40%

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Part 2 : Calculate

How full is the tank? (PercentFull)

$$\text{PercentFull} = (\text{GallonsLeft} / \text{GallonsInTank}) * 100$$

So multiply result by 100

- Example: Tank holds 10 gallons, and has 4 gallons left. How full (percent) is tank? 40%

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Part 2 : Calculate & Display

How full is the tank? (PercentFull)

```
set PercentFull to GallonsInCar / GallonsTankHolds * 100
say join Your gas tank ends up join PercentFull % full. for 2 secs
```

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Part 2 : Complete Code

All three values calculated and displayed.

```
ask How many miles was your trip? and wait
set TripMiles to answer
set GallonsUsed to TripMiles / MPG
say The amount of gallons of gas you used during the trip is: for 2 secs
say GallonsUsed for 2 secs
set GallonsInCar to GallonsTankHolds - GallonsUsed
say join You now have join GallonsInCar gallons of gas in your car. for 2 secs
set PercentFull to GallonsInCar / GallonsTankHolds * 100
say join Your gas tank ends up join PercentFull % full. for 2 secs
stop script
```

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Part 2 : Complete Code

All three values calculated and displayed.



```
ask How many miles was your trip? and wait
set TripMiles to answer
set GallonsUsed to TripMiles / MPG
say The amount of gallons of gas you used during the trip is: for 2 secs
say GallonsUsed for 2 secs
set GallonsInCar to GallonsTankHolds - GallonsUsed
say join You now have join GallonsInCar gallons of gas in your car. for 2 secs
set PercentFull to GallonsInCar / GallonsTankHolds * 100
say join Your gas tank ends up join PercentFull % full for 2 secs
stop script
```

Demo: GasMeter 2

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Rounding

The percent sometimes has a lot of messy decimal places.

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Rounding

The percent sometimes has a lot of messy decimal places.

There is an operator to fix this.

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Rounding

The percent sometimes has a lot of messy decimal places.

There is an operator to fix this. **Round**

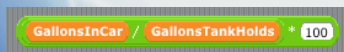


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Rounding Percent

The percent sometimes has a lot of messy decimal places.

There is an operator to fix this. **Round**

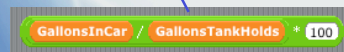


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Rounding Percent

The percent sometimes has a lot of messy decimal places.

There is an operator to fix this. **Round**



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Rounding Percent

The percent sometimes has a lot of messy decimal places.

There is an operator to fix this. **Round**



```
round GallonsInCar / GallonsTankHolds * 100
```

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Rounding Percent

The percent sometimes has a lot of messy decimal places.

There is an operator to fix this. **Round**



```
set PercentFull to round GallonsInCar / GallonsTankHolds * 100
```

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Complete Code

- Lets look at the complete code with the animated needle and sound effects. (Then we will come back and see how it works.)
- Demo: GasMeter

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Part 3: Add Multimedia

- Make the sprite a needle

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Part 3: Add Multimedia

- Make the sprite a needle
- Make the stage a car gas gauge (with E for empty and F for full)

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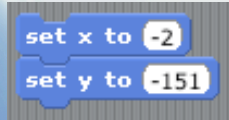
Part 3: Add Multimedia

- Make the sprite a needle
- Make the stage a car gas gauge (with E for empty and F for full)
- Place sprite needle below gauge in right spot.

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Part 3: Add Multimedia

- Make the sprite a needle
- Make the stage a car gas gauge (with E for empty and F for full)
- Place sprite needle below guage in right spot.

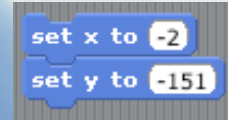


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Part 3: Add Multimedia

- Make the sprite a needle
- Make the stage a car gas gauge (with E for empty and F for full)
- Place sprite needle below guage in right spot.

How did I know the point was -2, -151?

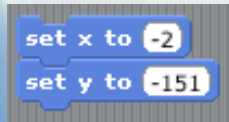


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Part 3: Add Multimedia

- Make the sprite a needle
- Make the stage a car gas gauge (with E for empty and F for full)
- Place sprite needle below guage in right spot.

I experimented....



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Part 3: Add Multimedia

- Make the sprite a needle
- Make the stage a car gas gauge (with E for empty and F for full)
- Place sprite needle below guage in right spot.
- Point end of needle towards E (again experiment)

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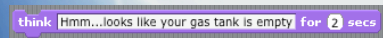
Part 3: Add Multimedia

- Make the sprite a needle
- Make the stage a car gas gauge (with E for empty and F for full)
- Place sprite needle below guage in right spot.
- Point end of needle towards E
- Indicate no gas in car

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Part 3: Add Multimedia

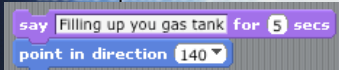
- Make the sprite a needle
- Make the stage a car gas gauge (with E for empty and F for full)
- Place sprite needle below guage in right spot.
- Point end of needle towards E
- Indicate no gas in car



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Part 3: Add Multimedia

- Make the sprite a needle
- Make the stage a car gas gauge
- Place sprite needle below gauge in right spot.
- Point end of needle towards E
- Indicate no gas in car
- Now say you are filling up tank and point needle sprite towards F.



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Part 3: Add Multimedia

- Make the sprite a needle
- Make the stage a car gas gauge
- Place sprite needle below gauge in right spot.
- Point end of needle towards E
- Indicate no gas in car
- Now say you are filling up tank and point needle sprite towards F
- And remember to move needle as gas is used

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Part 3: Math for pointing needle

- Experiment showed you needed to point the needle at 40 degrees to point to E
- And you needed to point needle at 140 degrees to point to F

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Part 3: Math for pointing needle

- Experiment showed you needed to point the needle at 40 degrees to point to E
- And you needed to point needle at 140 degrees to point to F
- This is exactly 100 apart

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Part 3: Math for pointing needle

- Experiment showed you needed to point the needle at 40 degrees to point to E
- And you needed to point needle at 140 degrees to point to F
- This is exactly 100 apart

WHAT LUCK !!!!!!!

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Part 3: Math for pointing needle

- Experiment showed you needed to point the needle at 40 degrees to point to E
- And you needed to point needle at 140 degrees to point to F
- This is exactly 100 apart
- For every 1 more percent of gas the tank is full, we can move needle 1 degree past 40 degrees.

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Part 3: Math for pointing needle

- Experiment showed you needed to point the needle at 40 degrees to point to E
- And you needed to point needle at 140 degrees to point to F
- This is exactly 100 apart
- For every 1 more percent of gas the tank is full, we can move needle 1 degree past 40 degrees.
Remember PercentFull is the variable.

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Part 3: Math for pointing needle

- Experiment showed you needed to point the needle at 40 degrees to point to E
- And you needed to point needle at 140 degrees to point to F
- This is exactly 100 apart
- For every 1 more percent of gas the tank is full, we can move needle 1 degree past 40 degrees.
Remember PercentFull is the variable. So:

point in direction 40 + PercentFull

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Part 3: Sound Effects

- For any sprite, you can have one or more sounds. You can import them if you want.

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Part 3: Sound Effects

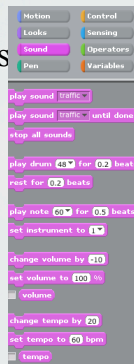
- For any sprite, you can have one or more sounds. You can import them if you want.



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Part 3: Sound Effects

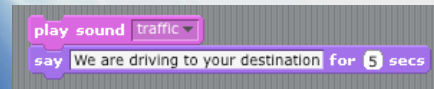
- There is a collection of statements for sounds:



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Part 3: Sound Effects

- So right before we ask how long the trip was, play the traffic sound and say we are taking the trip.



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The Whole Code

- Start on green, show and say tank is empty

```

when green flag clicked
  set x to 0
  set y to -151
  point in direction 40
  think [tmm...looks like your gas tank is empty] for 2 secs
  
```

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The Whole Code

- Ask MPG & size of tank, fill it up, move needle, say how far you can go on full tank

```

ask [How many miles per gallon does car get?] and wait
set MPG to answer
ask [How many gallons does your gas tank hold?] and wait
set GallonsTankHolds to answer
say [filling up your gas tank] for 5 secs
set PercentFull to 100
point in direction 140
set PossibleMiles to GallonsTankHolds * MPG
say [join The maximum number of miles you can travel is: PossibleMiles] for 4 secs
  
```

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The Whole Code

- Play traffic sound, drive to trip, ask how long it was and tell how much gas used

```

play sound [traffic]
say [We are driving to your destination] for 5 secs
ask [How many miles was your trip?] and wait
set TripMiles to answer
set GallonsUsed to TripMiles / MPG
say [The amount of gallons of gas you used during the trip is:] for 2 secs
say [GallonsUsed] for 2 secs
  
```

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The Whole Code

- Calculate and say how much gas left and how full tank now is and point needle properly to indicate gas has been used

```

set GallonsInCar to GallonsTankHolds - GallonsUsed
say [join You now have] join GallonsInCar [gallons of gas in your car] for 2 secs
set PercentFull to round GallonsInCar / GallonsTankHolds * 100
say [join Your gas tank ends up] join PercentFull [% full] for 2 secs
point in direction 40 + PercentFull
stop script
  
```

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```

when green flag clicked
  set x to 0
  set y to -151
  point in direction 40
  think [tmm...looks like your gas tank is empty] for 2 secs
  ask [How many miles per gallon does car get?] and wait
  set MPG to answer
  ask [How many gallons does your gas tank hold?] and wait
  set GallonsTankHolds to answer
  say [filling up your gas tank] for 5 secs
  set PercentFull to 100
  point in direction 140
  set PossibleMiles to GallonsTankHolds * MPG
  say [join The maximum number of miles you can travel is:] PossibleMiles for 4 secs
  play sound [traffic]
  say [We are driving to your destination] for 5 secs
  ask [How many miles was your trip?] and wait
  set TripMiles to answer
  set GallonsUsed to TripMiles / MPG
  say [The amount of gallons of gas you used during the trip is:] for 2 secs
  say [GallonsUsed] for 2 secs
  set GallonsInCar to GallonsTankHolds - GallonsUsed
  say [join You now have] join GallonsInCar [gallons of gas in your car] for 2 secs
  set PercentFull to round GallonsInCar / GallonsTankHolds * 100
  say [join Your gas tank ends up] join PercentFull [% full] for 2 secs
  point in direction 40 + PercentFull
  stop script
  
```

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Availability of Slides

Go to

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