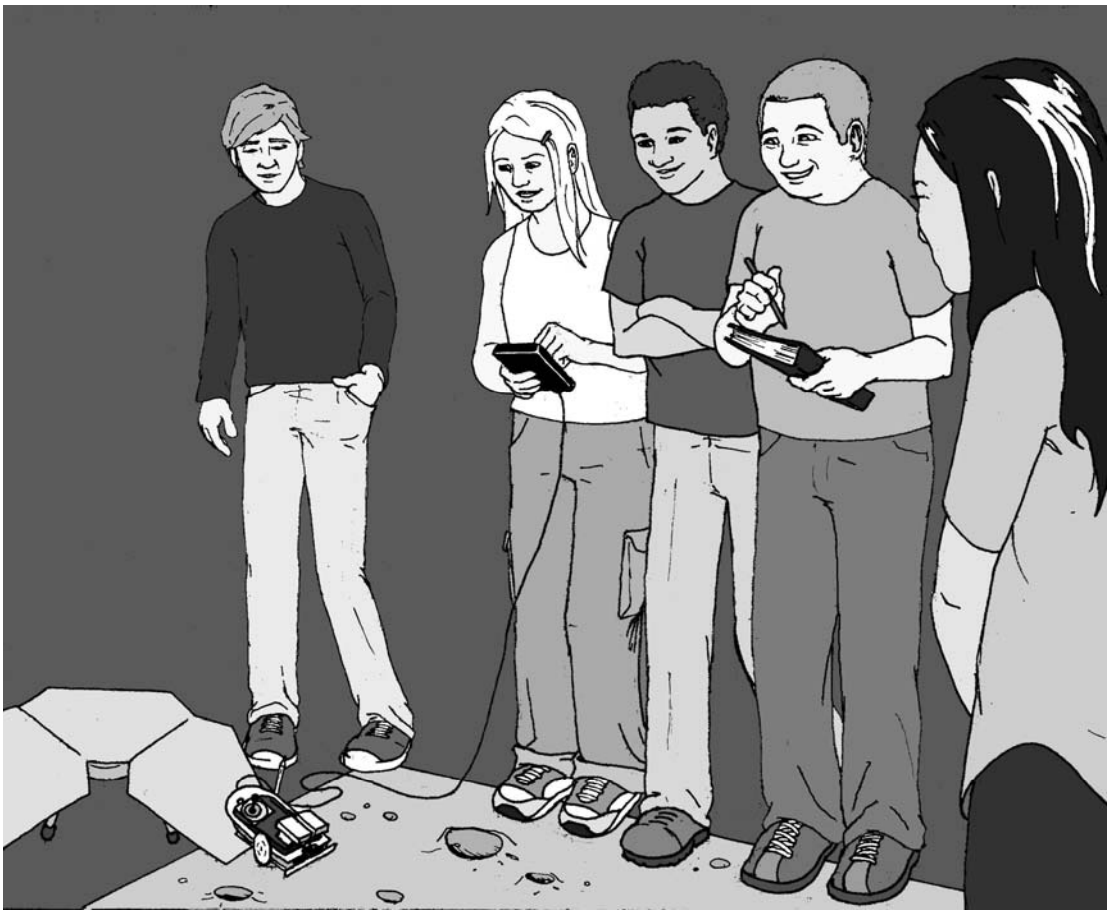
Name _____ Date _____

Mission to Mars Mission 9

Your robot has been selected for the next mission to Mars. All initial robot movements after landing have to be pre-programmed. After that, if you've successfully completed all previous missions, you're now ready to take full direct control of your robot to explore Mars.

YOU NEED:

1 Norland Calculator Robot
1 TI-83+ Calculator
1 84 inch Data Cable
1 Imagination
Program: **EXPLORE** or **EXPLORE2**



INSTRUCTIONS:

Upon landing, your robot needs to be pre-programmed to drive off the Mars landing vehicle and layout a two meter long transect line. At the end of the line the robot needs to trace out the perimeter of a one meter square rock sampling area. Place a marker at each corner of this sample area.

You are now ready to convert your robot to explorer mode. You have your choice of two programs. EXPLORE below uses the arrow keys on the TI-83 Plus and allows remote wire-control of four motions: forward, backward, left, and right. EXPLORE2 (last page) uses the number pad and controls nine different motions. Write one of the two programs on your TI-83 Plus.

```
Program:EXPLORE
ClrHome
Lb1 A
getKey->X
If X=24: Goto 2
If X=25: Goto 1
If X=26: Goto 3
If X=34: Goto 4
If X=1Ø5: Goto 5

Goto A
Lb1  1
ClrHome
Output (4,5, "FOR
EWARD")
Send ({122,1ØØ})

Get (R)
Goto A
Lbl 2
ClrHome
Output (4,7, "LEF
T")
Send ({1Ø2,42})
Get (R)
Goto A
Lbl 3
ClrHome
Output (4,6, "RIG
HT")
Send ({12Ø,42})
```

```
Get (R)
Goto A
Lbl 4
ClrHome
Output (4,5, "BAC
KWARD")
Send ({100,100})

Get (R)
Goto A
Lbl 5
Stop
```

Remove the TI-83 Plus from the robot. Replace the 12 inch black data cable connecting the robot to TI-83 Plus with an 84 inch black data cable. To move forward press the up arrow (or [8] key for EXPLORE2). To repeat a movement simply press the key again. To end either program press [ENTER]. Practice driving and maneuvering your Mars robot rover.

Add simulated equipment and sensors to the top of your robot: high gain antenna, solar array, sundial, instrument deployment device, low gain antenna, pancam, etc. Attach a velcro strip to the front of the robot for retrieving Mars rocks.

Your teacher will place rocks in the rock sample area and you need to retrieve as many as you can in 5 minutes.

Mission Data:

Trails	Rocks Recovered	Diameters Around
A		
B		
C		
Total		
Average		

Mars is millions of miles away and even at the speed of light a command from Earth may take several minutes to reach a robot rover on Mars. To see the results of the command would also take several minutes.

Place your robot one meter away from the rock sample area. Have a partner hold a cardboard visual barrier in front of you so you can't see the robot. You need to command the robot to retrieve a rock and return it to your starting point.

It might take 6 minutes for the robot to receive your commands on Mars and another 6 minutes for you to receive a visual image back. In other word a total of 12 minutes to see the results. For this demonstration you need only wait one minute to see the results of your commands. Don't crash your multimillion dollar rover!

QUESTIONS:

1. The Spirit and Opportunity Mars rovers have six wheels. What are the advantages and disadvantages of this configuration compared to your robot?

2. When the Spirit rover first disembarked off of the Mars Lander, it traveled 3 meters in 78 seconds. Compare this speed to the speed of your robot in meters per second.

3. The satellite, Voyager I, is beyond our solar system. When it was 7.555×10^9 miles away from Earth, how long did it take for a signal to reach Voyager and an acknowledgement signal to be received back on Earth? Answer in hours and use 186,000 miles per second as the speed of light.

Teacher Notes

Mission to Mars Mission 9

ACTIVITY NOTES:

You'll need to have some students make a cardboard Mars landing vehicle and some "rock" that can be picked up by velcro. There's plenty of information about Mars exploration on the Internet. At this writing, the Mars rovers, Spirit and Opportunity, are safely on Mars poised to make new discovers. The answer to question 3 is approximately 22.57 hours. Voyager I is traveling further away from Earth at a rate of over 91,000 miles per hour.

```
Program: EXPLORE2
ClrHome
Lb1 A
getKey->X
If X=73: Goto 1
If X=93: Goto 2
If X=82: Goto 3
If X=84: Goto 4
If X=74: Goto 5
If X=94: Goto 6
If X=72: Goto 7
If X=92: Goto 8
If X=83: Goto 9
If X=1Ø5:Goto 1
Ø
Goto A
Lb1  1
ClrHome
Output (4,5, "FOR
EWARD")
Send ({122,99})
Get (R)
Goto A
Lbl 3
ClrHome
Output (4,7, "LEF
T")
```

```
Send ({1Ø2,43})
Get (R)
Goto A
Lbl 4
ClrHome
Output (4,6, "RIG
HT")
Send ({12Ø,42})
Get (R)
Goto A
Lbl 2

ClrHome
Output (4,5, "BAC
KWARD")
Send ({1ØØ,99})
Get (R)
Goto A
Lbl 5
ClrHome
Output (4,5, "FOR
RIGHT")
Send ({12Ø,22})
Get (R)
Goto A
Lbl 6
ClrHome
Output (4,4, "BAC
KRIGHT")
Send ({12Ø,67})
Get (R)
Goto A
Lbl 7
ClrHome
Output (4,5, "FOR
LEFT")
Send ({1Ø2,22})
Get (R)
Goto A
Lbl 8
ClrHome
Output (4,5, "BAC
KLEFT")
Send ({1Ø2,67})
Get (R)
Goto A
Lbl 9
```

```
ClrHome
Output (4,6, "DEF
ENCE")
Send ({12Ø,99})
Get (R)
Send ({1Ø2,99})
Get (R)
Goto A
Lbl 1Ø
Stop
```