7th and 8th grade
Bryant Middle School
Holiday Packet

Turn this packet in completed on January 6th and you will be entered into a raffle.

Remember to read at least 20 minutes each day too!

No calculators for the math please!

9 × 6	2 × 3	7 × 2	4 × 6	8 × 3	2 × 2	1 × 4	8 × 9	9 × 5	4 × 9
7 × 1	2 × 7	2 × 1	8 × 5	4 × 0	9 × 0	5 × 5	7 × 5	6 × 3	3 × 3
7 × 3	4 × 3	5 × 1	6 × 6	0 × 3	6 × 0	2 × 4	0 × 7	1 × 3	2 × 8
8 × 6	3 × 5	0 × 5	4 × 1	1 × 7	7 × 0	0 × 4	4 × 2	4 × 8	4 × 4
7 × 9	5 × 8	4 × 7	3 × 0	1 × 2	5 × 9	1 × 1	1 × 0	7 × 7	3 × 9
6 × 1	3 × 2	8 × 2	0 × 9	9 × 1	2 × 0	5 × 3	4 × 5	5 × 4	9 × 3
6 × 9	6 × 4	3 × 8	5 × 2	7 × 8	1 × 8	5 × 0	8 × 0	8 × 8	1 × 9
9 × 4	9 × 7	6 × 7	9 × 2	6 × 8	2 × 9	6 × 2	8 × 4	1 × 6	0 × 2
1 × 5	9 × 8	3 × 4	2 × 5	2 × 6	3 × 6	9 × 9	7 × 6	7 × 4	0 × 0
8 × 1	0 × 6	3 × 1	0 × 1	5 × 7	0 × 8	5 × 6	3 × 7	6 × 5	8 × 7

INTEGERS RULES

ADDITION

Same Sign – Add and keep the sign

Different Signs – Subtract and take the sign of the larger absolute value

SUBTRACTION

Change to addition and change the sign of the second number.

Then follow the ADDITION rules.

MULTIPLICATION

Same Sign – Positive

Different Signs - Negative

DIVISION

Same Sign – Positive

Different Signs - Negative

Name_____

Adding/Subtracting Integers

Date_____ Period____

Find each sum.

1) $(-12) + 7$

2) $(-10) + (-7)$

3) $(-6) + 12$

4) $8 + 7$

5) $3 + 4$

6) $(-45) + 9$

7) $(-1) + (-46)$

8) $(-30) + 10$

9) $(-34) + 50$

10) $38 + (-5)$

Find each difference.

11) $2 - (-2)$

12) $(-1) - 10$

13) $8 - 7$

14) $(-8) - (-6)$

15) $11 - 4$

16) $48 - (-31)$

17) $18 - 41$

18) $(-38) - 30$

19) $(-1) - (-3)$

20) $(-1) - (-40)$

Evaluate each expression.

21) $(-10) - 47$

22) $(-29) - 29$

23) $13 + (-29)$

24) $38 + 22$

25) $(-32) - 44$

26) $(-12) + (-11)$

27) $2 + 15 + 4$

28) $16 + (-13) + 5$

29) $2 - (-9) - 8$

30) $10 + 3 - (-8)$

Add and Subtract Integers Worksheet

Description: This sheet includes drill like practice and then requires students to put this knowledge to real world use by keeping track of a personal checking account.

A Quick Diagnostic, Pre-Test

Calculate the following problems. If you can do all of these, you are in good shape.

1) $3 + 2$
2) $3 - 2$
3) $2 - 3$
4) $-4 + 5$
5) $-6 + 2$
6) $3 - -2$

SUBTRACT

Part II
A Negative From A Positive

1) $10-2$ 2) $11 - 2$

3) $5 - 7$ 4) $6 - 19$

5) $9 - 19$

A Negative From A Negative

6) $-5 - 11$ 7) $-9 - 10$

8) $-12 - 9$ 9) $-1-5$

The Hardest Case Subtracting a Negative Number

10) $5 - -3$ 11) $6 - -5$

12) $12 - -9$ 13) $15 - -8$

Activity
Directions: In a group of two complete this worksheet.

Your Bank Account
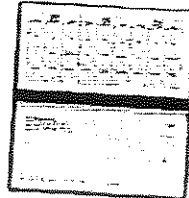
Directions: *Below is listed your starting balance at your bank as well as a series of withdrawals and deposits. Complete the table below by adding or subtracting the given amount and see how much money you have at the end.*

Starting balance (how much money you have at first) =   **$100**

Transaction	Current Amount
You deposit $10	$100+10 = $110
You write a $20 check for food	$110-20 = $90
Deposit $30	_____
Write a $40 check for new shirts	_____
Write a $220 check for two pairs of new shoes	_____
Deposit $300 (payday at work!)	_____
Write a $400 check for this month's rent	_____
Write a $50 check for groceries	_____
Deposit $150 (you won a raffle)	_____
Deposit $200 (A birthday present)	_____

What is the current amount in your checking account?_____

What would your account balance be if your identity was stolen and a $400 check was written (by the identity thief)? _____

Afterwards, you were able to convince your bank that you weren't responsible for writing the $400 check and the bank therefore deposited $400 back into your account. What would your balance be now?_____

Some Practice Problems

1. $5 - (-8) =$
2. $-7 - (+8) =$
3. $-9 - (+4) =$
4. $9 - (-2) =$
5. $-1 - 6 =$
6. $1 - (-9) =$
7. $-4 - 5 =$
8. $3 - 10 =$
9. $-8 - (-4) =$
10. $4 - 6 =$
11. $8 - (-9) =$
12. $-10 - 10 =$
13. $10 - (-10) =$
14. $10 - 10 =$
15. $25 - (-15) =$
16. $-33 - (-49) =$
17. $8 - 7 =$
18. $-6 - 8 =$
19. $-3 - (-7) =$
20. $14 - (-6) =$
21. $5 - 11 =$
22. $-8 - 6 =$
23. $-11 - (-4) =$
24. $13 - (-16) =$
25. $-6 - (-10) =$
26. $-7 - 0 =$
27. $6 - 13 =$
28. $-17 - 81 =$
29. $10 - (7 - 9) =$
30. $6 - (-9 + 7) =$
31. $6 + (-8 - 7) =$
32. $14 - (18 - 40) =$

Use the positive and negative rules to rewrite and answer the questions below. The first one is done for you.

6 - (-3) =   **6 + 3 = 9**   -4 - (+5) =

2 - (-7) =   -14 - (-6) =

-8 +(-6) =   9 + (-8) =

Answer the questions below.

2 - (-4) =   6 + (-3) =   -10 + (-4) =   -18 - (-7) =

5 + 6 =   11 - (-3) =   9 - 10 =   -6 + (-10) =

6 - 3 =   -7 - 4 =   -5 - (-2) =   4 - (-4) =

19 - 20 =   -15 - (-6) =   -7 - (-7) =   22 + (-5) =

-1 - (-9) =   6 + 4 =   -10 - 10 =   16 - (-8) =

12 + 7 =   14 - 6 =   76 - (-3) =   76 + (-6) =

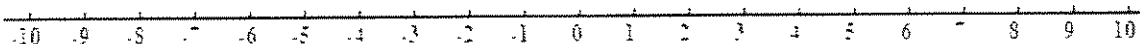-12 + 12 =   -7 - 4 =   60 + (-10) =   -12 - (-8) =

Use the integer line to answer the questions below. The first one is done for you.
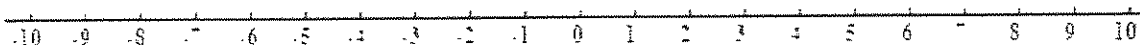
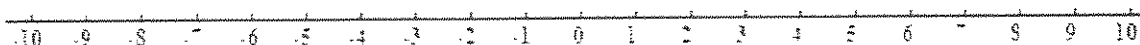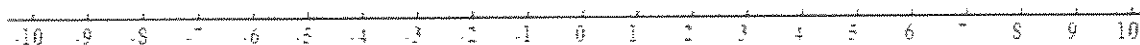#1:   -2 + 6 =   4

```
                              -6
        ●━━━━━━━━━━━━━━━━━━━▶
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10
```

#2:   -2 + 8 =

```
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10
```

#3:   -6 + 9 =

```
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10
```

#4:   -4 + 6 =

```
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10
```

#5:   -9 + 3 =

```
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10
```

#6:   -5 + 2 =

```
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10
```

#7:   2 + (-7) =

```
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10
```

#8:   6 + (-8) =

```
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10
```

#9:   -2 + (-5) =

```
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10
```

#10:   -3 + (-2) =

```
-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10
```
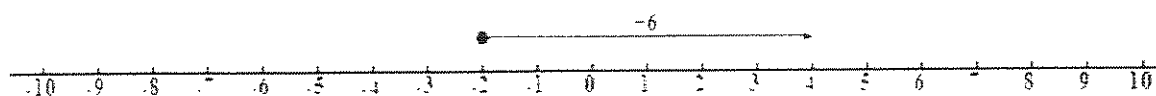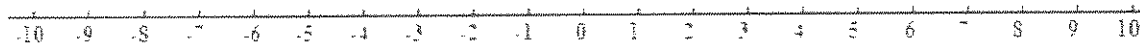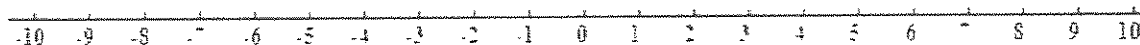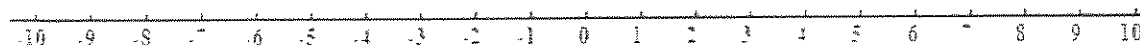
Adding and Subtracting Integers

Find each sum.

1) $3 + (-7)$

2) $(-10) + 12$

3) $(-5) + 8$

4) $(-4) + 6$

5) $(-8) + 12$

6) $6 + (-11)$

7) $(-7) + 2$

8) $(-12) + (-5)$

9) $(-12) + (-1)$

10) $(-9) + 11$

11) $(-4) + (-8) + 11$

12) $3 + (-11) + 8$

13) $(-4) + 6 + (-3)$

14) $1 + (-4) + 10$

15) $(-5) + (-5) + 1$

16) $1 + (-3) + 11$

17) $(-9) + 4 + 7$

18) $(-12) + 4 + 8$

19) $3 + (-10) + 6$

20) $(-3) + 3 + 12$

Find each difference.

21) $5 - 8$

22) $6 - 5$

23) $(-2) - (-8)$

24) $3 - 8$

25) $4 - 3$

26) $(-6) - 5$

27) $5 - 6$

28) $1 - 1$

29) $(-3) - 6$

30) $3 - (-2)$

31) $5 - 3 - (-2)$

32) $7 - (-6) - 7$

33) $(-4) - (-8) - 2$

34) $(-2) - (-1) - (-7)$

35) $2 - (-5) - 3$

36) $(-7) - (-7) - 4$

37) $(-6) - 4 - (-4)$

38) $(-8) - (-8) - 5$

39) $(-5) - 6 - (-6)$

40) $6 - (-3) - 1$

Adding Decimals

Place the decimal point in the sum.

1. $6.3 + 0.26 + 14.816 = 2\ 1\ 3\ 7\ 6$ 2. $7.069 + 4.274 + 13.5 = 2\ 4\ 8\ 4\ 3$

3. $32.09 + 8.027 + 16.8 = 5\ 6\ \ 9\ 1\ 7$ 4. $0.2 + 324.529 + 26.93 = 3\ 5\ 1\ 6\ 5\ 9$

Find the sum.

5. $4.3 + 1.5$ _____   6. $23.82 + 18.8$ _____   7. $9.606 + 0.42$ _____

8. $\$54.20 + \$5.93$ _____   9. $65.03 + 7.468$ _____   10. $13.076 + 0.08$ _____

11.	2.781	12.	43.17	13.	7.521	14.	4.7	15.	14.9
	13.284		2.899		40.28		21.58		621.8
	+ 6.63		+17.4		+ 0.1684		+ 4.123		+ 26.93

16. $\$0.45 + \$62.90 + \$23$ _____   17. $50.1 + 652.12 + 3,067 + 0.88$ _____

Mixed Applications

18. A tabletop is 4.717 centimeters thick. It is covered with a layer of 0.159 centimeter-thick laminated plastic. What is the total thickness?

_____

19. The monthly snowfall during the winter was 10.5 inches, 15.85 inches, and 8.6 inches. How much snow fell?

_____

20. In 1900, 4,192 cars were sold. In 1910, 181,000 cars were sold. How many more were sold in 1910 than 1900?

_____

21. One year, Vermont had 378,000 licensed drivers and Wyoming had 365,000. Which state had the greater number of licensed drivers?

_____

NUMBER SENSE

22. How is 2.36 different from 23.6? Is the sum 2.36 + 9.8 the same as the sum 23.6 + 9.8? Explain.

_____

_____

Subtracting Decimals

Place the decimal point in the difference.

1. $7.46 - 2.84 = 4\ 6\ 2$ 2. $17.17 - 5.7 = 1\ 1\ 4\ 7$ 3. $29.009 - 0.25 = 2\ 8\ 7\ 5\ 9$

Find the difference.

4. $9.8 - 3.95$ ___   5. $39.32 - 12.6$ ___   6. $239.8 - 73.91$ ___

7. $96.111 - 7.02$ ___   8. $1.009 - 0.83$ ___   9. $5.53 - 4.888$ ___

10. $7.27 - 3.621$ ___   11. $15.13 - 5.2$ ___   12. $17.3 - 2.519$ ___

13. $26 - 12.274$ ___   14. $6.036 - 4.71$ ___   15. $0.38 - 0.175$ ___

16. $89.5 - 30.48$ ___   17. $98 - 6.432$ ___   18. $100.8 - 92.44$ ___

| 19. $\begin{array}{r} 20.22 \\ -\ 2.555 \end{array}$ | 20. $\begin{array}{r} 4.3 \\ -0.99 \end{array}$ | 21. $\begin{array}{r} 83.8 \\ -\ 0.765 \end{array}$ | 22. $\begin{array}{r} 78.36 \\ -\ 9.05 \end{array}$ | 23. $\begin{array}{r} 578.32 \\ -\ 17.69 \end{array}$ | 24. $\begin{array}{r} 57.03 \\ -\ .0041 \end{array}$ |

Mixed Applications

25. Martin ran a race in 38.65 seconds. Herb finished 1.8 seconds before Martin. How long did it take Herb to run the race?

___

26. Luisa has 5 yards of ribbon. She uses 2.25 yards on a dress and 1.6 yards on a blouse. How much ribbon does she have left?

___

27. The LeMans 24-hour auto race covers 3,107.93 miles. Round the distance to the nearest 100 miles.

___

28. In 1906 the record speed for a car was 127.659 mph. In 1926 the record speed was 170.624 mph. About how much faster was the 1926 speed?

___

NUMBER SENSE

29. Look at the problems $10.6 - 8.9$ and $106 - 89$. How are they similar? Which problem has a greater difference?

___

Name _____

Date _____

Hour _____

Decimal Addition, Subtraction and Multiplication

1. 17.3 x 4 = _____

2. 56.2 x 8.9 = _____

3. 26 x 12.2 = _____

4. 6.036 x 4.71 = _____

5. 4.912 x 1.795 = _____

6. 8.74 x 3.6 = _____

7. 5.7 x 4.17 = _____

8. 61.5 x 602.1 = _____

9. 71.7 x 0.0324 = _____

10. 13.9 x 4.02 = _____

11. 7.45 – 2.85 = _____

12. 16.17 – 5.7 = _____

13. 29.008 – 0.35 = _____

14. 9.8 – 6.95 = _____

15. 1.019 + 0.93 = _____

16. 6.53 + 4.888 = _____

17. 8.27 + 3.621 = _____

18. 14.13 + 5.2 = _____

19. 2872 ÷ 8 = _____

20. 17,670 ÷ 62 = _____

YOU MUST SHOW ALL OF YOUR WORK HERE and on the BACK OF THE PAPER!!!

The Frost
By Hannah Flagg Gould

The frost looked forth on a still, clear night,

And whispered, "Now I shall be out of sight;

So through the valley and over the height

I'll silently take my way.

I will not go on like that blustering train,

The wind and the snow, the hail and the rain,

That make so much bustle and noise in vain,

But I'll be as busy as they!"

He flew up, and powdered the mountain's crest;

He lit on the trees, and their boughs he dressed

With diamonds and pearls;-and over the breast

Of the quivering lake he spread

A bright coat of mail, that it need not fear

The glittering point of many a spear

That he hung on its margin, far and near,

Where a rock was rearing its head.

He went to the windows of those who slept,

And over each pane, like a fairy crept;

Wherever he breathed-wherever he stepped-

Most beautiful things were seen

By morning's first light! There were flowers and trees,

With bevies of birds and swarms of bright bees;

There were cities-temples, and towers; and these,

All pictured in silvery sheen!

But one thing he did that was hardly fair-

He peeped in the cupboard, and finding there

That none had remembered for him to prepare,

"Now, just to set them a-thinking,

I'll bite their rich basket of fruit," said he,

"This burly old pitcher-I'll burst it in three!

And the glass with the water they've left for me

Shall 'tchick!' to tell them I'm drinking!

Name: _____ Date: _____

1. How is the movement of the frost through the valley described in the poem?

    A bustling
    B nosily
    C silently
    D blustering

2. Read the stanza: "He lit on the trees, and their boughs he dressed with diamonds and pearls..."

What did the frost do to the tree boughs?

    A The frost breathed on the trees.
    B The frost powdered the trees with snow.
    C The frost lit the branches with sparkling ice.
    D The frost spread a bright coat of sparkling armor like plates.

3. Read the first three lines of the poem. What do they communicate about the setting?

    A The frost is awakened by the clear morning sun.
    B The frost quietly moves through a clear night.
    C The frost ventured out during a windy and rainy evening.
    D The frost went blustering through the valley like a train at night.

4. Read the following lines: "There were flowers and trees,/ With bevies of birds and swarms of bright bees;/ There were cities-temples, and towers; and these,/ All pictured in silvery sheen!"

What does the word **bevies** mean?

    A different kinds
    B flocks
    C nests
    D a couple

5. What is the poet trying to communicate to the reader regarding frost?

    A Frost can move noisily like wind and snow.
    B Frost can get into your house and burst a pitcher.
    C Frost can be beautiful, but also destructive.
    D Frost can freeze lakes and make them look glittery.

6. Re-read the 1st stanza in the poem. For what purpose does the poet include a description of trains, wind, snow, hail and rain?

_____

_____

_____

7. Read the following lines from the poem: "Of the quivering lake he spread/ A bright coat of mail, that it need not fear/ The glittering point of many a spear." What did the frost most likely do to the lake? Why?

_____

_____

_____

8. The question below is an incomplete sentence. Choose the word that best completes the sentence.

The frost does not move as noisily as the wind and snow _____ the frost was just as busy.

    A and
    B because
    C but
    D so

9. Answer the following questions based on the sentence below.

On a still, clear night, the frost created beautiful sights by frosting the trees and powdering the mountain's crest.

Who? <u>the frost</u>

(did) What? _____

When? _____

How? _____

10. **Vocabulary Word**: quiver: shake with small movements.

Use the vocabulary word in a sentence: _____

_____

_____

3, 2, 1... Blast Off!

NASA
Now you can take a trip to
Mars without ever leaving
Earth.

A kid reporter journeyed to Mars aboard Disney's new space ride. Find out how close her ride was to the real thing.

Weekly Reader kid reporter Sonia Mia Diaz blasted into space. This 10-year-old from Florida was on a journey to Mars.

Sonia Mia rocketed to Mars aboard a new ride called Mission: SPACE. She experienced the ride during its opening week at Walt Disney World's Epcot Center in Orlando, Florida.

After her mission, Sonia Mia interviewed Sue Bryan, one of the ride's creators. Sonia Mia learned that Disney worked closely with the National Aeronautics and Space Administration (NASA) to develop the new space attraction. The ride lets people experience what a trip to Mars might be like in the future.

A Space Adventure

On her journey, Sonia Mia never actually left the ground. The ride gives people the feeling of blasting off and traveling through space. "We really wanted people to feel as close as they could to what it's like to be an astronaut," said Bryan.

Sonia Mia read quotes about space exploration as she waited in line. Information about space history fills the attraction. There is even a moon car called a lunar rover on loan from a museum.

An Intense Liftoff

Before boarding the shuttle, Sonia Mia and three other riders were given different roles for the mission. Those roles included commander, pilot, navigator, and engineer.

Sonia Mia was assigned to be the engineer. In real life, Sally Ride, the first U.S. woman in space, performed the same role.

After Sonia Mia strapped herself in, the shuttle moved into launch position. The countdown began, and the shuttle blasted off! During the mission, Sonia Mia and her team used buttons and joysticks to perform the tasks associated with their roles. The ride lasted about 4 minutes.

The mission was as intense as Sonia Mia had hoped. What was her favorite part? The liftoff! "I liked the intensity of the blastoff and the air pressure on my face," she said.

A Realistic Ride?

So how did the ride live up to a real space shuttle mission? Weekly Reader caught up with NASA astronaut Winston Scott to ask him that question.

Scott launched into space on two shuttle flights. He tested out Mission: SPACE and gave it a big thumbs up. "It's a thrill a minute," he said.

Although no astronauts have been to Mars yet, Scott said the ride's liftoff was realistic. The feeling of moving up the launch pad and being forced back into your seat were similar to those felt on a shuttle.

However, he points out, there are differences. In an actual launch, astronauts feel about three times the force of **gravity**. Gravity is the force that pulls things toward Earth.

The blastoff on the ride was also shorter than an actual liftoff. And, he said, riders don't experience weightlessness. On a real space shuttle, astronauts become weightless because there is no gravity.

For many people, the ride brings to mind the courage of space explorers. As Sonia Mia pointed out, "Going on the ride made me think about how brave astronauts are."

Interview With an Imagineer

Sonia Mia Diaz interviewed Sue Bryan, one of the forces behind Mission: SPACE. Here's what Sonia Mia learned.

Sonia Mia: What is an Imagineer?

Sue Bryan: Imagineers are people who work for Disney.

In general, Imagineering is about storytelling. We build attractions that put people who visit our parks into different worlds and stories. We also use technology to tell stories.

Sonia Mia: What was your role in creating the ride?

Bryan: I'm the senior show producer, which is like being a movie director. A movie director guides people and directs the show, including the lighting, music, artists, and motion you experience on the ride.

Sonia Mia: Where did your team get the inspiration for Mission: SPACE?

Bryan: People have always had an interest in space. The time and technology were right to create this new space attraction. We worked closely with NASA to develop the science and technology behind the attraction. No one has ever put people into a ride system like this before.

Sonia Mia: Before the ride, I was warned not to move my head or close my eyes because of motion sickness. I didn't feel sick, but might a person if he or she does those things?

Bryan: That could happen if you move your head, because of the technology used to create the ride. We give those recommendations because we want people to feel most comfortable. Some people can move their heads, and it doesn't bother them at all.

Sonia Mia: How many times have you been on Mission: SPACE?

Bryan: At last count, I've ridden it more than 400 times!

Name: _____   Date: _____

1. Visitors riding on Mission: SPACE are given roles before they board the shuttle. Which role is NOT offered on the ride?

    A pilot
    B navigator
    C scientist
    D engineer

2. What did astronaut Winston Scott find *similar* about the Mission: SPACE ride compared to his real space missions?

    A the feeling of moving up the launch pad
    B the feeling of three times the force of gravity during launch
    C the amount of time of the blast off
    D the feeling of weightlessness in space

3. Why would the ride creators work closely with NASA to build Mission: SPACE?

    A to provide space suits to riders
    B to understand the dangers of space travel
    C to make the ride as realistic as possible
    D to help prepare astronauts to visit Mars

4. Read the following sentence: "On a real space shuttle, astronauts become weightless because there is no gravity."

In the passage, the word **weightless** most nearly means

    A heavy
    B light
    C thick
    D weak

5. What is this passage mainly about?

    A a new museum
    B a new roller coaster
    C a new computer
    D a new space ride

6. How did Sonia Mia travel to Mars without leaving Earth?

_____

_____

_____

7. Sue Bryan tells Sonia Mia that she has ridden Mission: SPACE more than 400 times. As the senior show producer, why would it be important for her to ride that many times?

_____

_____

_____

8. The question below is an incomplete sentence. Choose the word that best completes the sentence.

_____ it feels like you are blasting off into space, the Mission: SPACE ride is quite thrilling.

    A yet
    B because
    C so
    D although

9. Answer the questions based on the sentence below.

Imagineers at Disney World Parks build attractions to put people in different worlds and stories.

Who? <u>imagineers</u>

(do) What? _____

Where? _____

Why? _____

10. Read the vocabulary word and definition below and complete questions 10a, 10b, and 11.

Vocabulary Word: associated (as · so · ci · at · ed): connected.

10a. Read the five sentences below and underline the word **associated** in each sentence.

1. Sue Bryan associated creating rides with storytelling.

2. The children associated birthdays with cake and presents because they received these every year.

3. The dog associated the bell with a treat because every time his owner rang the bell, he got a treat.

4. The police officers had to learn all the laws associated with their jobs, so they knew what to do on the job.

5. After visiting the farm and seeing how cows produced milk, the boy associated milk with cows.

10b. Which image is most likely associated with Halloween?
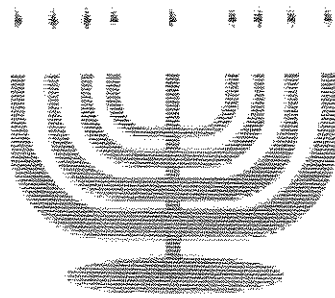
11. What qualities do you associate with being a successful student?

_____

_____

_____

_____

"Seven Minutes of Terror," Eight Years of Ingenuity
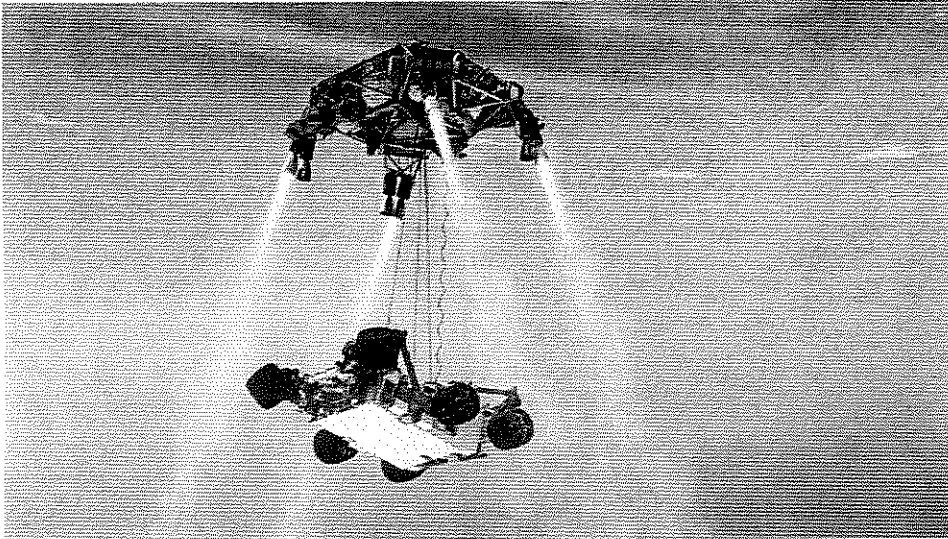
"Sometimes when we look at it, it looks crazy," remarked Adam Steltzner, an engineer who works for the National Aeronautics and Space Administration— known more commonly to the world as NASA. "It is the result of reasoned engineering thought. But it still looks crazy."

In a video story entitled "Seven Minutes of Terror," Steltzner was joined on camera by an eloquent cast of entry-descent-landing engineers (or "EDL Engineers"). Working from the Jet Propulsion Laboratory (JPL) in California, their team introduced the world to one of the most daring, inventive feats of engineering the world had ever witnessed: the pinpoint landing of NASA's Curiosity rover on Mars.

The seven minutes explored in that story—and experienced by the world in early August 2012—took place after seven years of engineering, one year of space flight, and countless hours of collaboration on the perfect landing. Dubbed the Mars Science Laboratory ("MSL"), this mission brought together more than 7,000 people, working in organizations from all over the world, to accomplish its goals. Split into two parts, the launch and the landing, MSL is one of the greatest technological accomplishments of human history.

The most impressive thing about MSL is that no mission this ambitious had ever been attempted in the past. The landing presented problems that could not be compared directly to anything done before. But thanks to the rigorous work of hundreds of engineers, NASA ended up making a new mark on Mars.

The Launch
The MSL launch took place on November 26, 2011. Blasting from the Earth at a speed of 12,582 miles per hour, the rockets that broke free of Earth's orbit and sent the Mars-bound shuttle on its way were the most routine part of the mission. For decades NASA has specialized in space launches, drawing on some of the brightest minds on the planet to determine what it takes to bring a shuttle to the stars.

Planning the shuttle's trip to the red planet (Mars's nickname, due to its color)—a voyage lasting about 36 weeks at maximum cruise velocity—was also not exactly a new challenge for engineers working on the MSL mission. NASA had already landed two rovers, named "Spirit" and "Opportunity," on the surface of the red planet. Based on the principles of astronomy, the launch engineers at JPL had very precise requirements for making the journey from Earth to Mars.

The key to these requirements was an understanding of orbits. Although Mars is significantly farther from the sun than Earth, both planets orbit the same star. Their distance from each other changes during each cycle, but Earth comes into alignment with Mars once every 26 months—"lapping" it in a perpetual race around the sun. Observing this pattern, astronomers can work with engineers to pinpoint the optimal month, day, and time for a space shuttle to leave Earth on a speedy one-way trip.

Drawing on centuries of knowledge of the laws of physics, scientists designed rockets and a shuttle to accommodate Curiosity. Years of calculation, construction, careful planning and computer modeling resulted in a vessel that cruised purposefully through space, reaching the orbit of Mars at just the right time to attempt a landing.

Through it all, the margin for error was nearly non-existent. The movement of interplanetary bodies in space is much more demanding than the movement of cars on a highway, or even airplanes in the stratosphere. Miscalculating a vector or failing to account for any aspect of the orbits could lead to a $2 billion failure.

Fortunately, NASA had taken on this challenge before. Its engineers had both the experience and the tenacity to succeed again. What came after the launch was different story.

The Landing
Spirit and Opportunity, the two NASA rovers that landed on Mars in 2004, used a combination of parachutes, rockets, and hi-tech airbags to protect themselves. Much like launch and spaceflight, each step of the landing sequence was planned and simulated to the very last detail. Learning from a prior Mars mission, EDL engineers were able to recreate some of the same maneuvers used in that sequence.

Unfortunately, the specific requirements of MSL made it difficult to depend on past experience. While NASA had constructed the biggest supersonic parachute ever made, parachuting was far from enough. Since the atmosphere of Mars is 100 times thinner than the atmosphere of Earth, the parachute alone could not reduce the speed of descent past 200 miles per hour—a breakneck speed that would surely damage Curiosity upon landing.

Curiosity outweighed any earlier rover and contained over 150 pounds of sensitive scientific devices, so an airbag solution was ruled out. Instead, EDL engineers designed a maneuver that would allow the entry capsule to turn sharply and activate powerful rockets to finish the job. Once this maneuver was complete, the capsule could attempt a vertical landing.

Successfully executing the switch from a parachute entry to a controlled, rocket-fueled descent was a feat that could have gone wrong at any moment. Still, even this was not enough to succeed. Once the parachute was cut, and a full radar system was online to guide Curiosity to the surface, the force from the rockets could kick up so much dust that the dust itself would damage the rover.

Eternally thinking one step ahead, EDL engineers designed a "sky crane" to complete the final step of the landing sequence. When it was 20 feet above Martian soil, the capsule lowered Curiosity onto the surface with a set of cables.

Moving from 13,000 miles per hour to zero miles per hour in just seven minutes, Curiosity finally touched down. The capsule, with all rockets still firing, blasted back into the sky and crash-landed elsewhere on the planet. The landing was a success.

The Ongoing Mission
MSL is the latest of NASA's attempts to learn more about Mars. The most popular inquiry is whether Mars may have, at any point in its long history, supported life as we know it. The search for these signs, however, is one piece of a much greater picture.

The mission has eight scientific objectives, each one broken into specific goals and all coming together to form a more detailed understanding of all things Mars. Curiosity, a rover the size of a station wagon, contains advanced instruments that will help it probe, sample, record, and analyze its way through Martian terrain. Collecting evidence on the biological, geological, chemical, and radiological profile of the red planet will prepare NASA for the next space flight to Mars. Another rover mission, building on the work of Curiosity, is planned to launch in 2020.

Ultimately, scientists hope to learn enough about Mars to bring human beings to the surface for a manned research mission. Some, working with entrepreneur Elon Musk, are even devising a plan to colonize the planet just one decade later. Skeptics debate whether or not such an outrageous idea could ever be made into reality.

Looking back at NASA's solutions to the great technical challenge of the Curiosity landing, it's hard to feel too skeptical about humankind's ability to reach for the stars.

Name: _____ Date: _____

1. What is Curiosity?

    A a parachute used to land on Mars
    B another name for the National Aeronautics and Space Administration
    C a space rover that landed on Mars
    D a video made by NASA engineers

2. What sequence of events is described in this passage?

    A the sequence of events that led to Opportunity landing on Mars
    B the sequence of events that led to Curiosity landing on Mars
    C the sequence of events that led to the creation of NASA
    D the sequence of events that will need to take place for Mars to be colonized

3. In order to land on Mars, Curiosity had to use a parachute, rockets, and a sky crane.

What can be concluded from this information?

    A Landing on Mars is a simple process.
    B Landing on Mars is a complicated process.
    C Landing on Mars is a waste of time.
    D Landing on Mars in the future is unrealistic.

4. What helped make the Mars Science Laboratory mission successful?

    A one person working by himself for decades
    B two countries competing with each other
    C a lot of people working together for years
    D hi-tech airbags first used in 2004

5. What is this passage mainly about?

    A a mission to Mars
    B life on Mars
    C what being an engineer is like
    D the history of NASA

6. Read the following sentence: "The **mission** has eight scientific objectives, each one broken into specific goals and all coming together to form a more detailed understanding of all things Mars."

What does the word **mission** mean?

    A a problem that develops when people do not prepare for something as much as they should
    B a short period of time when people feel extremely nervous about something
    C the movement of interplanetary bodies
    D an important task to be carried out by a person or group of people

7. Choose the answer that best completes the sentence below.

Engineers spent years getting Curiosity ready; _____, it landed on Mars.

    A finally
    B however
    C third
    D such as

8. Describe the video story "Seven Minutes of Terror."

_____

_____

_____

_____

9. Which seven minutes of terror does the video's title refer to? Support your answer with evidence from the passage.

_____

_____

_____

_____

10. Why might the engineers who worked on Curiosity have felt terror as they watched it land? Support your answer with evidence from the passage.

_____

_____

_____