REED GOLD MINE
AMERICA'S FIRST GOLD DISCOVERY

Teacher's Guide:

Mathematics

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Mathematics

Section I: Expanded Notation and Written Numerals

Objective: This activity has students practice expanded notation and written numerals by rewriting numerals in a paragraph.

Expanded Notation and Written Numerals

Change the numerals into expanded notation:

173 = _____+_____+_____

5,491 = _____+_____+_____+_____

761,853= _____+_____+_____+_____+_____+_____

Spell out the numerals. Use one letter in each space:

11 = ___ ___ ___ ___ ___ ___

48 = ___ ___ ___ ___ ___ - ___ ___ ___ ___ ___

472= ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ - ___ ___ ___

Directions: Change the numbers in the following story into expanded notation or spell out the numerals. Put one letter in each space when spelling out the numerals.

According to the story, in 1799 (___ + ___ + ___ + ___) John Reed's 12 (___ + ___) year old son, Conrad, went bow and arrow fishing 1 (___ ___ ___) day down at the creek on his father's farm. The young boy saw something shiny and yellow in the waters of Little Meadow Creek. He waded into the water and hauled out a 17 (___ + ___) pound chunk of gold. The family used it as a doorstop for 3 (___ ___ ___ ___ ___) years. John Reed sold it for $3.50

(___ ___ ___ ___ ___ dollars and ___ ___ ___ ___ ___ cents) but the gold rock was worth a lot more. It was worth $3,600 (_____ + _____). Today that gold nugget would be worth about $399,277 (_____ + _____ + _____ + _____ + _____ + _____).

Expanded Notation and Written Numerals Answer Key

Change the numerals into expanded notation

173= 100+70+3

5,491= 5,000+400+90+1

761,853= 700,000+60,000+ 1,000+ 800+50+3

Spell out the numerals

11= ELEVEN

48= FORTY-EIGHT

472= FOUR HUNDRED AND SEVENTY-TWO

Directions: Change the numbers in the following story into expanded notation or spell out the numbers.

According to the story, in 1799 (**1000+ 700+ 90+ 9**) John Reed's 12 (**10**+ **2**) year old son, Conrad, went bow and arrow fishing 1 (**ONE**) day down at the creek on his father's farm. The young boy saw something shiny and yellow in the waters of Little Meadow Creek. He waded into the water and hauled out a 17 (**10** + **7**) pound chunk of gold. The family used it as a doorstop for 3 **(THREE)** years. John Reed sold it for $3.50

(**THREE** dollars and **FIFTY** cents) but the gold rock was worth a lot more. It was worth $3,600 (**$3,000** + **600**). Today that gold nugget would be worth about $399,277 (**300,000 + 90,000 + 9,000 + 200 + 70 + 7).**

Mathematics

Section II: Using Graphs and Charts

Objective: Students learn about graphs and charts by answering questions and creating their own using information provided about Reed Gold Mine.

Using Graphs and Charts

Reed Gold Mine has a series of adits, also known as horizontal tunnels. The four main adits are Linker, Morgan, Tunnel #3, and Sawmill. The approximate lengths and approximate years opened are:

Linker, 150 feet long, opened around 1833.

Morgan, 85 feet long, opened around 1840.

Tunnel #3, 75 feet long, opened around 1880.

Sawmill, 60 feet long, and opened around 1895.

The Main Rocks and percentage of rocks found in each adit are as follows; Linker has 40% greenstone, 30% argillite, and 30% quartz. Morgan has 70% greenstone, and 30% quartz. Tunnel #3 had approximately 50% greenstone, 30% argillite, and 20% quartz. Sawmill had 20% greenstone, and 80% argillite.

1. Complete the following chart using the information found in the above paragraph.

Adit/Crosscut Name	**Approximate Length**	**Main Rocks**	**Approximate Year Opened**
Linker Adit			
Morgan Crosscut			
Saw Mill Adit			
Tunnel #3 Adit **(Lower Hill Trail)**			

2. White quartz is the stone in which gold is found. Which of the adits/crosscuts has quartz?

3. Using the chart from the 1st problem, make a bar graph showing the lengths of the adits/crosscuts. Use a separate sheet of paper to complete the graph.

4. Using the bar graph you created in problem 3, which adit or crosscut is the longest and what is its length?

5. Using the bar graph you created in problem 3, which adit or crosscut is the shortest and what is its length?

Excavation Times

Kind of Rock	Time to Excavate per Inch
Greenstone	45 minutes
Quartz	30 minutes
Argillite	10 minutes

6. Tunnel #3 consist of about 23 feet of argillite, 15 feet of quartz, and about 36 feet of greenstone. Using the chart above, how long would it take to dig Tunnel #3?
   Hints: 1-foot equals 12 inches. Then find the length of time it would take to dig each kind of rock.

7. If Tunnel #3 had 2 more feet of greenstone, how much longer would it take to complete the adit?

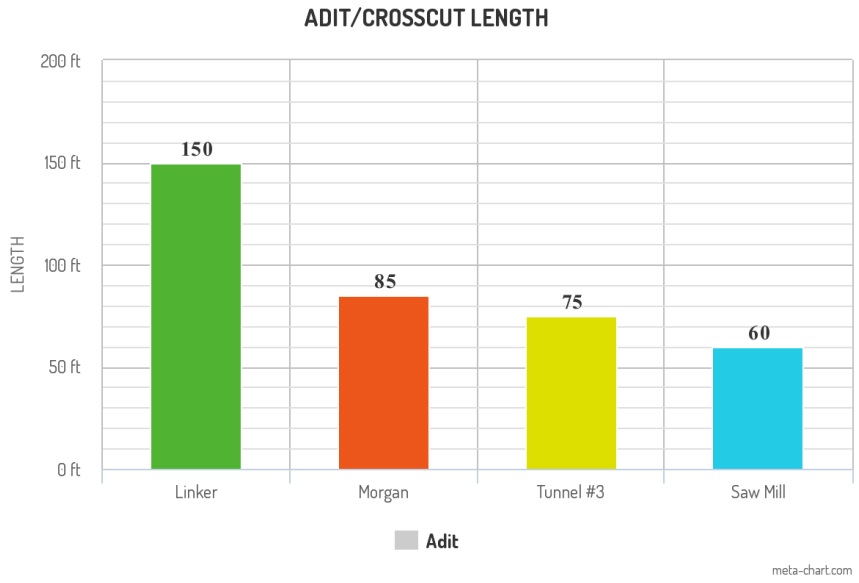
Using Graphs and Charts Answer Key

1. Complete the chart above using the information found in the above paragraph.

Adit/Crosscut Name	Approximate Length	Main Rocks	Approximate Year Opened
Linker Adit	150 feet	Greenstone (40%) Argillite (30%) Quartz (30%)	1833
Morgan Crosscut	85 feet	Greenstone (70%) Quartz (30%)	1840
Tunnel #3 Adit **(Lower Hill Trail)**	75 feet	Greenstone (50%) Argillite (30%) Quartz (20%)	1880
Saw Mill Adit	60 feet	Argillite (80%) Greenstone (20%)	1895

2. Milky quartz is the stone in which gold is found. Which of the adits/crosscuts has quartz?
   Linker, Morgan, Tunnel #3

3. Using the chart from problem 1, make a bar graph showing the lengths of the adits/crosscuts. Use a sheet of paper to make the graph.



4. Which adit or crosscut is the longest and what is its length?
   Linker, 150 ft

5. Which adit or crosscut is the shortest and what is its length?

   Sawmill, 60 ft

6. Using the information on the rock types present, why was the shortest adit not expanded?

   Possible answer: The adit had to be long to reach the veins of quartz. It was the first adit mined, so they thought there could be more gold if they continued. The other adits and crosscuts were so deep they were too far below the water table of the water to be safely removed and Linker was intended to help with drainage

Excavation Times

Kind of Rock	Time to Excavate per Inch
Greenstone	45 minutes
Quartz	30 minutes
Argillite	10 minutes

7. Tunnel #3 consist of about 23 feet of argillite, 15 feet of quartz, and about 36 feet of greenstone. Using the chart above, how long would it take to dig Tunnel #3? (Hints: 1-foot equals 12 inches. Then find the length of time it would take to dig each kind of rock.)

Argillite: 23 x 12= 276 inches: 276 x 10 = 2760 minutes; 2760 minutes = 46 hours

Quartz: 15 x 12 = 180 inches; 180 x 30 = 5400 minutes; 5400 minutes = 90 hours

Greenstone: 36 x 12 = 432 inches; 432 x 45 = 19,440 minutes = 324 hours

Total: 46+90+324= 460

8. If Tunnel #3 had 2 more feet of greenstone, how much longer would it take to complete the adit?

   2 x 12 = 24 inches; 24 x 45 = 1080 minutes; 1080 minutes = **Answer is 18 hours**

Price of Gold

Average Annual Price of Gold Per Ounce

(US Dollars-Actual Terms)

Year	Average Price Per Ounce	Year Low	Year High	Difference Between low and High Price
2020	$1696.94	$1472.35	$2061.50	
2019	$1393.34	$1270.05	$1542.60	
2018	$1268.93	$1176.70	$1360.25	
2017	$1260.39	$1162.00	$1351.20	
2016	$1251.92	$1073.60	$1372.60	
2015	$1158.86	$1049.60	$1298.00	
2014	$1266.06	$1144.50	$1379.00	
2013	$1409.06	$1192.75	$1692.50	
2012	$1668.86	$1537.50	$1790.00	
2011	$1573.16	$1316.00	$1896.50	
2010	$1226.66	$1052.25	$1426.00	
2009	$973.66	$813.00	$1218.25	
2008	$872.37	$692.50	$1023.50	
2007	$696.43	$608.30	$841.75	
2006	$604.34	$520.75	$725.75	
2005	$444.99	$411.50	$537.50	
2004	$409.53	$373.50	$455.75	
2003	$363.83	$319.75	$417.25	
2002	$310.08	$277.80	$348.50	
2001	$271.19	$256.70	$292.85	
2000	$279.29	$263.80	$316.60	

Complete the chart the above by finding the difference of the high and low prices of each year**.** Then use the chart above to answer the following questions.

1. Which year had the biggest difference in the high and low prices? What was the difference?

2. Which year had the smallest difference in the high and low prices? What was the difference?

3. How many years was the average price between $1,000 and $1,300?

4. List the 5 years for the highest average price.

5. List the 5 years with the lowest average price.

6. If you bought 1 ounce of gold in 2000, in what year would you need to sale it to make the highest profits? How much profit would you make?
   Hint look at the High Price column

7. Use the average price on the chart to determine how much each nugget would be worth for the years given. Then figure out the difference in the prices.

   a) 2-ounce nugget in 2008, in 2015: difference between the two numbers.

   b) 4-ounce nugget in 2000, in 2007: difference between the two numbers.

   c) 6-ounce nugget in 2017, in 2020: difference between the two numbers.

Price of Gold Answer Key

Average Annual Price of Gold Per Ounce

(US Dollars-Actual Terms)

Year	Average Price Per Ounce	Year Low	Year High	Difference Between low and High Price
2020	$1696.94	$1472.35	$2061.50	**$589.15**
2019	$1393.34	$1270.05	$1542.60	**$272.55**
2018	$1268.93	$1176.70	$1360.25	**$183.55**
2017	$1260.39	$1162.00	$1351.20	**$189.20**
2016	$1251.92	$1073.60	$1372.60	**$299.00**
2015	$1158.86	$1049.60	$1298.00	**$248.40**
2014	$1266.06	$1144.50	$1379.00	**$234.50**
2013	$1409.06	$1192.75	$1692.50	**$499.75**
2012	$1668.86	$1537.50	$1790.00	**$252.50**
2011	$1573.16	$1316.00	$1896.50	**$580.50**
2010	$1226.66	$1052.25	$1426.00	**$373.75**
2009	$973.66	$813.00	$1218.25	**$405.25**
2008	$872.37	$692.50	$1023.50	**$331.00**
2007	$696.43	$608.30	$841.75	**$233.45**
2006	$604.34	$520.75	$725.75	**$205.00**
2005	$444.99	$411.50	$537.50	**$126.00**
2004	$409.53	$373.50	$455.75	**$82.25**
2003	$363.83	$319.75	$417.25	**$97.50**
2002	$310.08	$277.80	$348.50	**$70.70**
2001	$271.19	$256.70	$292.85	**$36.15**
2000	$279.29	$263.80	$316.60	**$52.80**

Complete the Chart the above by finding the difference of the High and Low prices of each year. Then use the chart above to answer the following questions.

1. Which year had the biggest difference in the high and low prices? What was the difference? **Year 2020; Difference is $589.15**

2. Which year had the smallest difference in the high and low prices? What was the difference? **Year 2001; Difference is $36.15**

3. How many years was the average price between $1,000 and $1,300?
   5 Years in total (Listed latest to earliest); 2010, 2014, 2015, 2016, 2017, 2018

4. List the 5 years for the highest average price and list their price.
   2020 ($1696.94), 2019 ($1393.34), 2013 ($1409.06), 2012 ($1668.86), 2011 ($1573.16)

5. List the 5 years with the lowest average price and list their price.
   2000 ($279.29), 2001 ($271.19), 2002 ($310.08), 2003 ($363.83), 2004 ($409.53)

6. If you bought 1 ounce of gold in 2000, in what year would you need to sale it to make the largest amount of profits? What would those profits be? (Hint look at the High Price column) **Sell in 2020 for a profit of $1744.90**

7. Use the average price on the chart to determine how much each nugget would be worth for the years given. Then figure out the difference in the prices.

   a) 2-ounce nugget in 2008, in 2015: difference in the prices.

   Price per ounce in 2008 = $872.37 **Price per ounce in 2015 = $1158.86**

   872.37 x 2 = $1744.74 in 2008 **1158.86 x 2 = $2317.72 in 2015**

   $2317.72-$1744.74 = $572.98 difference

   b) 4-ounce nugget in 2000, in 2007: difference in the prices.

   Price per ounce in 2000 = $279.29 **Price per ounce in 2007 = $696.43**

   $279.19 x 4 = $1116.76 in 2000 **$696.43 x 4 = $2785.72 in 2007**

   $2785.72 - $1116.76 = $1668.96

   c) 6-ounce nugget in 2017, in 2020: difference in the prices.

   Price per ounce in 2017 = $1260.39 **Price per ounce in 2020 = $1696.94**

   $1260.39 x 6 = $7562.34 **$1696.94 x 6 = $10181.64**

   $10181.64 - $7562.34 = $2619.30

Mathematics

Section III: Stem and Leaf Graphs

Objective: Students learn to create and use stem and leaf graphs to solve word problems.

Stem and Leaf Graphs with Word Problems

There have been several large nuggets found at Reed Gold Mine. The 6 largest have weighed 28, 23, 17, 13, 10 and 7 pounds troy.

NOTE: Gold and metal are weighed on the troy system. A troy pound has 12 troy ounces rather than 16.

1. Convert each of the nugget weights given above into troy ounces.

2. Create a stem and leaf plot to show the weight using troy pounds for the larger nuggets of gold found at Reed Gold Mine.

3. Create a stem and leaf plot to show the weight using troy ounces for the larger nuggets of gold found at Reed Gold Mine.

4. Which is greater, the number of nuggets that weigh more than 20 pounds troy or between 10 and 20 pounds troy?

5. How many nuggets weigh between 15 to 20 pounds troy?

6. How many nuggets weigh between 100 to 250 troy ounces?

7. How many nuggets weigh between 1 to 15 pounds troy?

8. If you were to create a bar graph showing the different weights of the nugget, which nugget would have the longest bar? Which would have the shortest?

9. Create a bar graph using the information from the stem plot you created in Question 3.

10. If the price for one ounce of gold was $185, how much would the 3 largest nuggets be worth?
    Hint: Each troy pound has 12 troy ounces

11. If the price for one ounce of gold was $235, how much would the 3 smallest nuggets be worth?
    Hint: Each troy pound has 12 troy ounces

Stem and Leaf Graphs with Word Problems Answer Key

The have been several large nuggets found at and around Reed Gold Mine. The 6 largest have weighed 28, 23, 17, 13, 10 and 7 pounds troy.

NOTE: Gold and metal are weighed on the troy system. A troy pound has 12 troy ounces rather than 16.

1. Convert each of the nugget weights given above into troy ounces. (Remember one troy pound equals 12 troy ounces)

   28 x 12 = 336 Troy Ounces **23 x 12 = 276 Troy Ounces**

   17 x 12 = 204 Troy Ounces **13 x 12 = 156 Troy Ounces**

   10 x 12 = 120 Troy Ounces **7 x 12 = 84 Troy Ounces**

2. Create a stem and leaf plot to show the weight using troy pounds for the larger nuggets of gold found in the Reed Gold Mine area.

Stem	**Leaf**
0	7
1	0 3 7
2	3 8

3. Create a stem and leaf plot to show the weight using troy ounces for the larger nuggets of gold found in the Reed Gold Mine area.

Stem	**Leaf**
8	4
12	0
15	6
20	4
27	6
33	6

4. Which is greater, the number of nuggets that weigh more than 20 pounds troy or between 10 and 20 pounds troy?

   10-20

5. How many nuggets weigh between 15 to 20 pounds troy?
   1

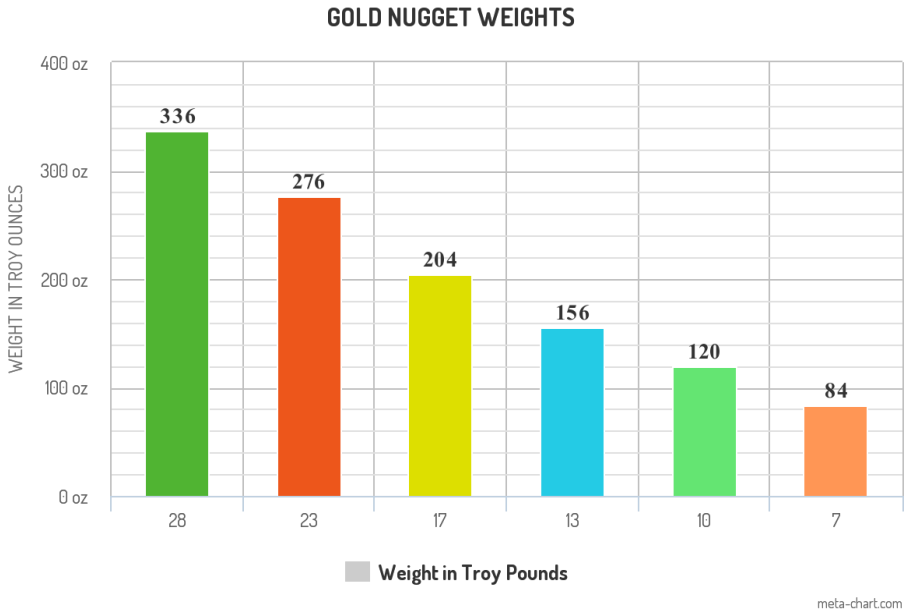
6. How many nuggets weigh between 100 to 250 troy ounces?
   3

7. How many nuggets weigh between 1 to 15 pounds troy?
   3

8. If you wanted to create a bar graph showing the different weights of the nugget, which nugget would have the longest bar? Which would have the shortest?

   28-pound nugget would be the longest; 70-pound nugget would be the shortest

9. Create a bar graph using the information from the stem plot you created in **Question 3**.



10. If the price for one ounce of gold was $185, how much would the 3 largest nuggets be worth each?
    Hint: Each troy pound has 12 troy ounces

    Largest Nuggets are 28, 23, 17 troy pounds

    28 x 12 = 336 Troy Ounces **336 x 185 = $62,160**

    23 x 12 = 276 Troy Ounces **276 x 185 = $51,060**

    17 x 12 = 204 Troy Ounces **204 x 185 = $37,740**

11. If the price for one ounce of gold was $235, how much would the 3 smallest nuggets be worth each?
    Hint: Each troy pound has 12 troy ounces

    Smallest Nuggets are 13, 10, 7 troy pounds

    13 x 12 = 156 Troy Ounces **156 x 235 = $36,660**

    10 x 12 = 120 Troy Ounces **120 x 235 = $28, 200**

    7 x 12 = 84 Troy Ounces **84 x 235 = $ 19,740**

Mathematics

Section IV: Math Game

Objective: Students learn to use multiplication to crack a secret code.

Secret Code

Directions: Use your multiplication facts to solve these problems. Then on the line below the problem, decode the secret fact about Reed Gold Mine.

A 24	**B 84**	**C 42**	**D 45**	**E 60**	**F 4**	**G 75**	**H 88**
I 12	**J 37**	**K 23**	**L 30**	**M 49**	**N 18**	**O 54**	**P 32**
Q 59	**R 72**	**S 20**	**T 40**	**U 63**	**V 77**	**W 142**	**X 1**
Y 27	**Z 85**						

4 3 8 10 5 12 9

X3 X6 X4 X6 X8 X5 X7

___ ___ 1803, ___ ___ ___ ___ ___

9 2 5 6 9 7 3 9 5 15

X5 X6 X4 X7 X6 X9 X20 X7 X12 X3

___ ___ ___ ___ ___ ___ ___ ___ ___ ___

4 11 1 2 4 36 3 6 5 8

X10 X8 X60 X15 X6 X2 X25 X10 X4 X5

___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

2 7 3 15 5 20

X9 X9 X25 X6 X12 X2

___ ___ ___ ___ ___ ___ at Reed Gold Mine.

Secret Code Answer Key

Directions: Use your multiplication facts to solve these problems. Then on the line below the problem, decode the secret fact about Reed Gold Mine.

A 24	B 84	C 42	D 45	E 60	F 4	G 75	H 88
I 12	J 37	K 23	L 30	M 49	N 18	O 54	P 32
Q 59	R 72	S 20	T 40	U 63	V 77	W 142	X 1
Y 27	Z 85						

4	3		8	10	5	12	9
X3	X6		X4	X6	X8	X5	X7
I	**N**	**1803,**	**P**	**E**	**T**	**E**	**R**

9	2	5	6	9	7	3	9	5	15
X5	X6	X4	X7	X6	X9	X20	X7	X12	X3
D	**I**	**S**	**C**	**O**	**V**	**E**	**R**	**E**	**D**

4	11	1		2	4	36	3	6	5	8
X10	X8	X60		X15	X6	X2	X25	X10	X4	X5
T	**H**	**E**		**L**	**A**	**R**	**G**	**E**	**S**	**T**

2	7	3	15	5	20	
X9	X9	X25	X6	X12	X2	
N	**U**	**G**	**G**	**E**	**T**	**at Reed Gold Mine.**