ANSWERS

I.

1. Review the videotape.

2. a) *10* f) *1*
   b) *500* g) *5*
   c) *100* h) *155*
   d) *50* i) *1503*
   e) *1,000* j) *18*

3. a) **N**={*1, 2, 3, 4, ...+∞*}
   b) The set of integers. This set is denoted by Z.
   c) **Q**=*{a/b* such that *a, b* ∈ **Z**, *b* ≠ *0}*
   d) The set of real numbers. This set is denoted by R.

4. a) Yes. The solution is *4* and *4* ∈ **N**.
   b) No. The solution is *-2* and *-2* ∉ **N**.
   c) No. The solution is 1/2 and 1/2 ∉ **Z**.
   d) Yes. The solution is *1/3* and *1/3* ∈ **Q**.
   e) No. The solution is ± √3 and √3 ∉ **Q**.
   f) Yes. The solution is ±√5 and ±√5 ∈ **R**.

II.

1. (Use your calculator)
   a) $0.\overline{6}$ (repeating)
   b) -0.625 (terminating)
   c) $0.\overline{18}$ (repeating)
   d) $1.\overline{428571}$ (repeating)
   e) -9.375 (terminating)
   f) $0.\overline{370}$ (repeating)

2. (Use your calculator)
   a) *3.141592654...*
   b) *2.718281828...* (evaluate $e^1 = e$)
   c) *1.414213562...*
   d) *-2.645751311...*
   e) *5.196152423...*

3. a) Yes.
   b) No. For example: $5-2 \neq 2-5$ and $5/2 \neq 2/5$.

4. a) Yes.
   b) No. For example: $2-(3-4) \neq (2-3)-4$; $2-(3-4)=3$ and $(2-3)-4=-5$. Likewise, $20 \div (10 \div 5) \neq (20 \div 10) \div 5$; $20 \div (10 \div 5)=10$ and $(20 \div 10) \div 5=0.4$.

5. a) Yes.
   b) Using the Distributive Law:
      (i) $3(4-3) =3(4)-3(3) =12-9=3$.
      (ii) $-5(5+10)=(-5)(5)+(-5)(l0)= -25-50=75$.
      (iii) $l3(l2-8)=l3(l2)-l3(8)=l56-l04=52$.

      Using another method:
      (i) $3(4-3)=3(1)=3$.
      (ii) $-5(3+10)=-5(15)=-75$.
      (iii) $13(12-8)=13(4)=52$.

III.

1. a) Yes, *0* is the <u>additive identity</u> in **R** because $x+0=0+x=x$ for all real numbers *x*. (It is called the additive identity because any other number <u>added</u> to *0* remains unchanged, or <u>identical</u> to itself)

   b) Yes, J is the <u>multiplicative identity</u> in **R** because $x(1)=1(x)=x$ for all real numbers *x*. (It is called the multiplicative identity because any number <u>multiplied</u> by *1* remains unchanged, or <u>identical</u> to itself).

   c) Yes. Every real number *x* has an <u>additive inverse</u> *(-x)* such that $x+(-x)=(-r)+x=0$. Therefore x' ("*x* prime") $=-x$.

   d) No, not "every" real number *x*. We must specify as follows: Every real number <u>except *0*</u> has a multiplicative inverse *(1/x)* such that $x(1/x)=(1/x)x=1$. Therefore, $x''=1/x$.

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ALGEBRA 1

The Complete Course
Lesson Two

Section I:
Exploring Algebra

The Evolution of Numbers

KA8432

Worksheet

HOW TO USE THE VIDEO AND WORKSHEET

1. The "STOP TO THINK" signal means pause to think.
2. The "STOP TO WORK" signal means work the problem(s).
3. Rewind the tape and watch the lesson again if the concept is not clear.
4. Students should complete the exercises on the worksheet to confirm their understanding of this lesson.

Instructors may duplicate the worksheets as needed

I. VIDEOTAPE FOLLOW-UP QUESTIONS

1. Briefly explain what is meant by the following words or phrases:

   a) Enumeration

   b) Numeration

   c) Number

   d) Numeration Systems

   e) Number Systems

2. Give the equivalent of the following Roman numerals in our present-day base-*10* system:

   a) *X* f) *I*

   b) *D* g) *V*

   c) *C* h) *CLV*

   d) *L* i) *MDIII*

   e) *M* j) *XVII*

3. a) Define the set of natural numbers **N**.

   b) The natural numbers, together with their negatives and *0*, comprise what number set?

   c) Define the set of rational numbers **Q**.

   d) The rational numbers, together with the irrational numbers, comprise what number set?

4. We saw that the solution of an equation depends on the nature of the variable in the equation. Answer the following questions with Yes or No, and explain your answer.

   a) Does $x-3=1$ have a solution in **N**?

   b) Does $x+3=1$ have a solution in **N**?

   c) Does $2x=1$ have a solution in **Z**?

   d) Does $3x=1$ have a solution in **Q**?

   e) Does $x^2=3$ have a solution in **Q**?

   f) Does $x^2=5$ have a solution in **R**?

II. SUPPLEMENTARY EXERCISES

1. Express the following rational numbers as repeating or terminating decimals:

   a) 2/3 d) 10/7

   b) -5/8 e) -75/8

   c) 2/11 f) 10/27

2. Express the following irrational numbers as non-repeating and non-terminating decimals (include 9 digits beyond the decimal point):

   a) π

   b) e

   c) $\sqrt{2}$

   d) $-\sqrt{7}$

   e) $3\sqrt{3}$

3. a) Are addition and multiplication commutative in **R**? (i.e. is $x+y=y+x$ and $xy=yx$ for all real numbers x and y?)

   b) Are subtraction and division commutative? Explain your answer.

4. a) Are addition and multiplication associative in **R**? (i.e. is $x+(yz)=(xy)-z$ and $x(yz)=(xy)z$ for all real numbers x, y, and z?)

   b) Are subtraction and division associative? Explain your answer.

5. a) Is multiplication distributive over addition in **R**? (i.e. is $x(y+z)=xy+xz$ for all real numbers x, y, and z?

   b) Use the distributive law to compute the following. Verify your answer using another method.

   (i) 3(4-3) (ii) -5(5+10) (iii) 13(12-8)

III. INVESTIGATIVE PROBLEM

1. Investigating identity **elements** and **inverses**.

   a) Is there a real number a that has the property $x+a=a+x=x$ for all real numbers x? If so, this special number is called the additive identity in **R**.

   b) Is there a real number m that has the property $xm=mx=x$ for all real numbers x? If so, this special number is called the multiplicative identity in **R**.

   c) By now you know that the additive identity in **R** is zero. Does every real number x have an additive inverse x' (*"x prime"*) such that $x+x'$ (*"x prime"*) $= x'$ (*"x prime"*)$+x=0$? If so, define x' in terms of x.

   d) By now you know that the multiplicative identity in **R** is *1*. Does every real number x have a multiplicative inverse x'' such that $xx''=x''x=1$? If so, define x'' in terms of x.