PART I

UNIT 1

FOCUS A

Exercises

1. In the passage above find all the nouns which form their plurals irregularly and those that have only a singular or plural form. (Write their singular and plural forms if possible).

irregular plurals: calculus – calculi, parabola – parabolae/-as, hyperbola – hyperbolae/-as, maximum – maxima/-mums, minimum – minima/-mums;

nouns used only in singular form: geometry, algebra, precision, rigor;

a noun in plural taking verbs in singular: mathematics (*see* the explanation at the end of Unit 1);

a noun having the same form both in singular and in plural: series

2. Put into the singular form:

a) hypothesis
b) polyhedron
c) abscissa
d) rhombus
e) nucleus
f) radius
g) thesis
h) axis / vertex
i) curriculum

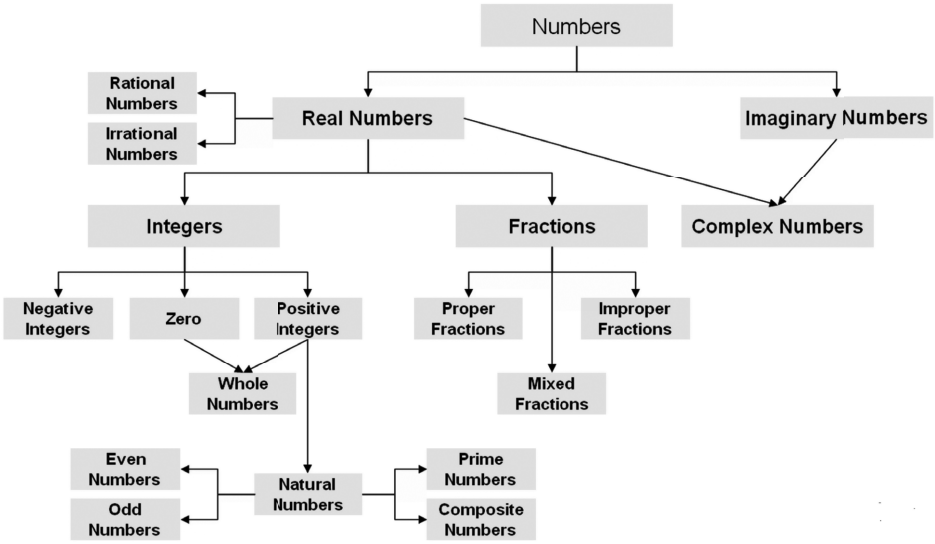
3. Choose the correct word for each of the following sentences and give the plural form:

a) apices
b) phenomena
c) crises
d) media
e) lemmata
f) criteria
g) formulae
h) analyses
i) maxima
j) loci

4. Fill in a suitable expression in the correct form:

a) emphasis
b) formulae
c) data
d) criteria
e) radii
f) focus
g) spectra
h) crises
i) nucleus / nuclei
j) matrices

5. Complete the following diagram:



State whether the following statements are true or false:

a) An integer is a rational number. – **T Since any integer can be formatted as a fraction by putting it over 1.**
b) A rational is an integer. – **F Not necessarily; $^{4}/_{1}$ is an integer, but $^{2}/_{3}$ is not.**
c) A number is either a rational or an irrational, but not both. – **T In decimal form, a number is either non-terminating and non-repeating (so it's an irrational) or not (so it's a rational); there is no overlap between these two number types.**

Classify according to number type; some numbers may be of more than one type:

a) 0.45
This is a terminating decimal, so it can be written as a fraction: $^{45}/_{100} = {}^{9}/_{20}$. Since this fraction does not reduce to a whole number, then it is not an integer or a natural. And everything is a real, so the answer is: **rational, real.**
b) 3.14159265358979323846264338327950288419716939937510 **...**
You probably recognize this as being pi, though this may be more decimal places than you customarily use. The point, however, is that the decimal does not repeat, so pi is an irrational. And everything (that you know about so far) is a real, so the answer is: **irrational, real.**
c) 3.14159
Don't let this fool you! Yes, you often use something like this as an *approximation* of pi, but it isn't pi! This is a rounded decimal approximation, and, since this approximation *terminates*, this is actually a rational, unlike pi which is irrational. The answer is: **rational, real.**
d) 10
Obviously, this is a counting number. That means it is also a whole number and an integer. Depending on the text and teacher (there is some inconsistency), this may also be counted as a rational, which technically-speaking it is. And of course it's also a real. The answer is: **natural, whole, integer, rational** (possibly)**, real.**
e) $^{5}/_{3}$
This is a fraction, so it's a rational. It's also a real, so the answer is: **rational, real.**

f) $1\,{}^{2}/_{3}$
This can also be written as ${}^{5}/_{3}$, which is the same as the previous problem. The answer is: **rational, real, mixed fraction**

g) –sqrt(81)
Your first impulse may be to say that this is irrational, because it's a square root, but notice that this square root simplifies: *–sqrt*(81) = –9, which is just an integer. The answer is: **integer, rational, real. (note:** *sqrt* = square root)

h) ${}^{-9}/_{3}$
This is a fraction, but notice that it reduces to –3, so this may also count as an integer. The answer is: **integer** (possibly)**, rational, real.**

6. Rewrite these expressions into mathematical symbols:

a) $x^* \approx 0.213$

b) $|x| \leq x!$

c) $\binom{10}{9} = 10$

d) $\ddot{x} > \hat{x}$

e) $\binom{n}{k} \neq \binom{n+1}{k+1}$

7. Read out the following notation (Fundamental Symbols and Combinatorics):

FOR INSTANCE:

a) the absolute value of the quotient *a* over *b* is equal to the absolute value of *a* over the absolute value of *b*
b) *k* combinations of *n* things are equal to *n* choose *k* and it is equal to *n* factorial over the product of *k* factorial and *n* minus *k* factorial
c) *a* asterisk is greater than or equal to *a* roof which is greater than or equal to *a* tilde
d) *a* is less than or equal to the absolute value of *a*
e) *A* is equal to the open interval five, plus infinity
f) *a* is approximately equal to two point oh five six
g) the permutation of *n* entities is equal to *n* factorial
h) the multiset permutation of $k_1, k_2, \ldots k_n$ entities is equal to the factorial of the sum of $k_1, k_2, \ldots$ and k_n over the product of k_1 factorial, k_2 factorial … and k_n factorial
i) the absolute value of *a* minus the absolute value of *b* is less than or equal to the absolute value of the difference of the absolute value of *a* and the absolute value of *b* which is less than or equal to the absolute value of *a* plus or minus *b* which is less than or equal to the sum of the absolute value of *a* and the absolute value of *b*
j) *k* variations of *n* entities are equal to *n* factorial over the factorial of the difference *n* minus *k*
k) the absolute value of *a* is equal to the absolute value of minus *a*
l) the absolute value of *x* is greater than five
m) *x* is less than or equal to five
n) *k* combinations with repetition of *n* entities is equal to *n* plus *k* minus one choose *k*

8. Read the assignments below. Find solutions to the problems and explain the procedures:

a) 10
b) 1
c) 60
d) 6
e) 36

FOCUS B

LINES AND ANGLES

I. Lines

2. Look at the figure and say which lines are:

a) vertical – *XC*, *YF*, *ZQ*
b) parallel – *AB* || *CD*, *XC* || *YF* || *ZQ*
c) oblique – *AD*
d) horizontal – *AB*, *CD*
e) curved – *XPZ*
f) straight – *CX*, *QZ*, *FY*, *AB*, *AD*, *CD*
g) perpendicular – *CX*, *FY*, *QZ* ⊥ *AB*, *CD*

3. Which word (in capital letters) is being described below?

FAR

4. Using the words you have learned, describe the following capital letters:

a) K – one vertical straight line, two oblique lines
b) B – one vertical straight line, two curved lines
c) M – two vertical straight lines, two oblique lines
d) E – one vertical straight line, three horizontal straight lines
e) I – one vertical straight line
f) L – one vertical straight line, one horizontal line
g) A – one horizontal straight line, two oblique lines
h) X – two oblique lines intersecting one another
i) Z – two horizontal lines, one oblique line
j) O – one (closed) curved line

5. Complete the following sentences:

a) straight; Straight, horizontal, oblique
b) intersect, equidistant, parallel

II. Angles

1. What kind of angle does a clock make at?

a) two o'clock? – an acute angle
b) three o'clock? – a right angle
c) four o'clock? – an obtuse angle
d) twenty to ten? – a reflex angle
e) twelve minutes past seven? – a reflex angle
f) twenty-nine minutes past twelve? – an obtuse angle

(clockwise and counterclockwise orientation may be discussed)

2. Name the kinds of angles shown in these figures:

a) α - a right angle
β - a reflex angle
γ - an obtuse angle
δ - an acute angle

b) α - an acute angle
β - an acute angle
γ - an acute angle
δ - an obtuse angle
ε - an obtuse angle

c) α - an acute angle
β - an acute angle
γ - an obtuse angle
δ - a reflex angle

3. Are the following statements true or false?

a) F (only one can be accute)

b) F (only one can be obtuse)
c) T
d) T
e) F (with one obtuse angle)

4. Describe the figure:

AB and CD are two parallel horizontal lines. A transverse line EF intersects AB and CD at G and H. Lines connect A to E, B to E, C to F and D to F.

5. Look at the figure above and read the following:

- Now make similar statements about EGB:

∠EGB = ∠AGH	*vertically opposite* angles (Vert. opp.∠ s)
∠EGB = ∠GHD	*corresponding* angles (Corr. ∠s)
∠EGB = ∠CHF	*alternate* angles (Alt. ∠s)
∠EGB + ∠EGA = 180°	*adjacent* angles *on a straight line* (Adj. ∠s)

- Find other angles in the diagram which are equal and say why. If EB is equal and parallel to CF, compare ∆ CHF and ∆ EGB. Give reasons for what you say.
  ∠CHF = ∠EGB (vertically opposite and corresponding angles)
  ∠CFH = ∠GEB (alternate angles)
  ∆ CHF and ∆ EGB are congruent

6. Complementary and supplementary angles:

Are the angles complementary, supplementary or neither?

99 degrees and 81 degrees?	..... sup.
34 degrees and 56 degrees?	..... com.
25 degrees and 65 degrees?	..... com.
3 degrees and 158 degrees?	..... neither
143 degrees and 37 degrees?	..... sup.