NAME: _____

DATE: _____

DSA

Alternate Base Systems for Cross-Curricular Fun & Engineering Applications

HANDOUT FOR INDIVIDUAL WORK
Level 6 – Exponents and Conversions

We often use a decimal system for counting. We start over when we count every 10 numbers.
When we use the binary system we start over after every two numbers.
When we use the octal system we start over every _____ numbers.
When we use the dozenal system we start over every _____ numbers.
When we use the hexadecimal system we start over every _____ numbers.
When we use the vigesimal system we start over every _____ numbers.
When we use the sexagesimal system we start over every _____ numbers.

It is correct to say that in any base we start over every 10 numbers; but for the questions above, please write numbers in the decimal base.

COUNTING IN DIFFERENT BASES: Every base has its own 10.

Binary: Ten and other large numbers are reached very quickly in base-2 (binary).
1,
10,
11, 100,
101, _____, 111, 1000,
1001, _____, _____, _____, 1101, _____, _____, _____, _____,
10001, 10010, 10011, 10100, 10101, 10110, 10111, 11000, 11001, 11010, 11011, 11100, 11101, 11110, 11111, 100000,

Octal: A multiple of 10 is reached every eight numbers in the Octal base.
Can you please write 1 to 30 in the Octal base in the space below?

QUESTION: Can you convert between the Binary, Octal, and Decimal bases?
Example: What would 7 in Decimal Base be in the Binary Base? 7 Decimal = 111 in Binary
Example: What would 16 in the Decimal Base be in the Octal Base? 16 Decimal = 20 in Octal

Please write examples of conversions of your own below:

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EXPONENTS: Exponents of numbers are expressed as a number multiplied by itself as many times as is represented by the exponent. IN ANY BASE, 10 is still 10, regardless of how many or few other numbers are between.

Thus 10^0 means 10 multiplied by itself zero times = 1
Thus 10^1 means 10 multiplied by itself one time = 10
Thus 10^2 means 10 multiplied by itself (10x10) two times = _____
Thus 10^3 means 10 multiplied by itself (10x10x10) three times = _____

What would 10^5 be? _____ = _____

Please calculate the exponents in different bases:

How does 10^2 look:

In Decimal Base = _____

In Binary Base = _____

In Octal Base = _____

In Dozenal Base = _____

How does 10^6 look:

In Decimal Base = _____

In Binary Base = _____

In Octal Base = _____

In Dozenal Base = _____

Are the exponents in different base systems different from one another? YES NO

Please explain the reason for your answer to the prior question:

_____

_____

_____

_____

Do you understand how different bases work? YES A LITTLE BIT NO

When you and your neighbor are both done with the work, explain alternate-bases and conversions to him or her; then let your neighbor explain alternate bases and conversions to you.

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| | | | | | | | | | | |

Think about the Dozenal-base system:
One, two, three, four, five, six, seven, eight, nine, dec, el, ten.
Notice that in order to count up to 10 in dozenals, we must include two extra numbers,
Dec and El. Mathematicians have agreed to call the two extra Dozenal numbers Dec and El.

Nobody has ever decided which symbols we should use for Dec and El. Maybe you can help.
Below, please make up your own shapes for the two extra Dozenal numbers, Dec and El.
Draw them next to their names: DEC and EL and circle your best efforts for each number.

DEC

EL