Important Terms

**Natural numbers:**

**Ellipsis:**

**Divisible:** If \( a \div b \) has a remainder of 0, then \( a \) “is divisible by” \( b \).

*Examples:*

*Conjecture:*

Inductive Reasoning -

**Ex 1.** If 2 odd numbers are multiplied together, will the product always be an odd number? Using inductive reasoning what is your conjecture?

**Ex 2.** If an odd and even number are added together, will the sum be odd or even? Using inductive reasoning what is your conjecture?
Ex 3.

<table>
<thead>
<tr>
<th>Pick a number.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiply the number by 4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Add 6 to the product.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Divide the sum by 2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtract 3 from the quotient.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Now, do the process again.

Make a conjecture about the relationship between the original number and the final number.

This is a prediction using induction (or inductive reasoning.)

One way to prove a conjecture is false is by a ______________________________, which satisfies the conditions of the conjecture, but gives a different result.

Ex 4. Find a counter-example to the conjecture “an even number times an even number is odd.”

Not all conclusions found by inductive reasoning are correct.

We made a conjecture using inductive reasoning. To PROVE – use deductive reasoning.

Deductive Reasoning:
Ex 5. Prove using deductive reasoning that using the given procedure (from Example 3) will always result in the final number being twice the original number.

To use deductive reasoning, we begin with the general case rather than specific examples.

We can use a variable, $n$, to represent any number.

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Practice Problems

Ex 6. Use inductive reasoning to predict the next line in the pattern.

\[
\begin{align*}
9 \times 14 &= 126 \\
9 \times 15 &= 135 \\
9 \times 16 &= 144 \\
\_ \times \_ &= \_
\end{align*}
\]

Ex 7. Use inductive reasoning to predict the next line in the pattern.

\[
\begin{align*}
3 \times 37 &= 111 \\
6 \times 37 &= 222 \\
9 \times 37 &= 333 \\
12 \times 37 &= 444 \\
\_ \times \_ &= \_
\end{align*}
\]

Ex 8. Use inductive reasoning to predict the next number in the sequence.

\[
\begin{align*}
27, 23, 19, 15, 11, \ldots \\
27, 23, 19, 15, 11, \_\_\_\_, \ldots
\end{align*}
\]

Ex 9. Use inductive reasoning to predict the next number in the sequence.

\[
\begin{align*}
36, 49, 64, 81, \ldots \\
36, 49, 64, 81, \_\_\_\_, \ldots
\end{align*}
\]
Ex 10. Use inductive reasoning to predict the next three numbers in the pattern.

\[-1, 2, -4, 8, \ldots\]

\[-1, 2, -4, 8, \underline{32}, \underline{64}, \underline{128}\]

Ex 11. Use inductive reasoning to predict the next three numbers in the pattern.

\[\frac{1}{5}, \frac{1}{9}, \frac{1}{13}, \ldots\]

\[1, \frac{1}{5}, \frac{1}{9}, \frac{1}{13}, \underline{\frac{1}{17}}, \underline{\frac{1}{21}}, \underline{\frac{1}{25}}\]

Ex 12. Use inductive reasoning to predict the next three numbers in the pattern.

\[0, 1, 1, 2, 3, 5, 8, 13, \ldots\]

\[0, 1, 1, 2, 3, 5, 8, 13, \underline{21}, \underline{34}, \underline{55}\]

Ex 13. Find the letter that is the 118th entry in the following sequence.


Ex 14. Find the letter that is the 112th entry in the following sequence.

\[Z, D, D, D, Z, D, D, D, Z, D, D, D, \ldots\]

Ex 15. Identify the next figure in the pattern.

\[A) \quad B) \quad C) \quad D)\]
**Ex 16.** Find the 5\(^{th}\) triangular number that corresponds to the following dot sequence.

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1  3  6  10
```

**Ex 17.** Find the 6\(^{th}\) square number that corresponds to the following dot sequence.

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1  4  9  16
```