Use the code below to answer the following questions.

```plaintext
x = 17
for i from 0 to n-1
    x = x * (x-2)
```

1) Assuming all arithmetic can be done in hardware, what is the asymptotic runtime of this algorithm?

\[ O(n) \]

2) Assuming all arithmetic can be done in hardware, what is the asymptotic space requirement of this algorithm?

\[ O(1) \]

3) If \( n \) is large enough that the arithmetic needs to be done in software, what is the asymptotic space requirement of this algorithm?

If \( m \) is the size of the largest value that \( x \) gets to, it is

\[ O(\log(m)) \]

Exactly what this is, is unclear. To find an upper bound, let us assume that the third line is “\( x = x \cdot x \)”. In this case we construct the table below to see the first four values of \( n \):

<table>
<thead>
<tr>
<th>( n )</th>
<th>( x )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( 17^2 )</td>
</tr>
<tr>
<td>2</td>
<td>( 17^4 )</td>
</tr>
<tr>
<td>3</td>
<td>( 17^8 )</td>
</tr>
<tr>
<td>4</td>
<td>( 17^{16} )</td>
</tr>
</tbody>
</table>

From this we see that the value of \( x \) is \( O(17^{2^n}) \). Hence the space requirement is:

\[ O(\log(17^{2^n})) = O(2^n \cdot \log(17)) = O(2^n) \]