JavaScript

```
// A validator to check and verify something has a factored form...
function factorCheck(f,g) {
    // This validator is designed to check that a student is submitting a factored polynomia
    //  Checking that there are the correct number of non-numeric and non-inverse factors as
    //  Checking that the submitted answer and the expected answer are the same via real Xro
    //  Checking that the outer most (last to be computed when following order of operations

    var operCheck = f.tree[0];// Check to see if the root operation is multiplication at enc
    var studentFactors = f.tree.length;// Temporary number of student-provided factors (+1 b

    // Now we adjust the length to remove any numeric factors, or division factors, etc to a
    for (var i = 0; i < f.tree.length; i++) {
        if ((typeof f.tree[i] === 'number')||(f.tree[i][0] == '-')||(f.tree[i][0] == '/')) {
            studentFactors = studentFactors - 1;
        }
    }

    // Now we do the same with the provided answer, in case sage or something provides a wei
    var answerFactors = g.tree.length;

    // Adjust length in the same way, so that it will match the students if it should.
    for (var i = 0; i < g.tree.length; i++) {
        if (typeof g.tree[i] === 'number') {
            answerFactors = answerFactors - 1;
        }
    }

    // Note: An especially dedicated student could pad with weird factors that are happen to
    // For example, a student could enter sin^2(x)+cos^2(x) as a multiplicative factor to pa
    // This would be somewhat difficult to think of, even on purpose.
    // Until I can reliably evaluate the factors themselves as functions though, there isn't

    return ((f.equals(g))&&(studentFactors==answerFactors)&&(operCheck=='*'))
    }
```

Note: Make sure to **fully** factor each of the below. Remember that, factor by grouping is just **one** step in the factoring process, you should check any resulting factors you get after factor by grouping (or any other factoring method) to see if they are still factorable.

Problem 1 *Factor the following polynomial:*

$$3\,x^3 + x^2 - 3\,x - 1 = \boxed{(3\,x+1)(x+1)(x-1)}$$

Feedback(*`attempt`*): *You want to factor by grouping, so you want to group up terms into pairs and then factor out any common terms from each pair. For example, if you had* $9x^3+8x^2-144x-128$ *then you could group it as* $(9x^3+8x^2)+(-144x-128)$*, then factor out any common factors in each group;* $x^2(9x+8)+-16(9x+8)$*, then pull out the common term in the parentheses (only works if they are the same!) to get* $(9x+8)(x^2-16)$*. This isn't the end though; you need to fully factor, so you need to check both terms to see if either is factorable, in this case* (x^2-16) *is factorable to* $(x-4)(x+4)$ *which gets you* $(9x+8)(x-4)(x+4)$ *as your final factoring.*

Problem 2 *Factor the following polynomial:*

$$3\,x^3-5\,x^2-12\,x+20=\boxed{(3\,x-5)(x+2)(x-2)}$$

Feedback(*`attempt`*): *You want to factor by grouping, so you want to group up terms into pairs and then factor out any common terms from each pair. For example, if you had* $9x^3+8x^2-144x-128$ *then you could group it as* $(9x^3+8x^2)+(-144x-128)$*, then factor out any common factors in each group;* $x^2(9x+8)+-16(9x+8)$*, then pull out the common term in the parentheses (only works if they are the same!) to get* $(9x+8)(x^2-16)$*. This isn't the end though; you need to fully factor, so you need to check both terms to see if either is factorable, in this case* (x^2-16) *is factorable to* $(x-4)(x+4)$ *which gets you* $(9x+8)(x-4)(x+4)$ *as your final factoring.*

Problem 3 *Factor the following polynomial:*

$$2\,x^3+5\,x^2-128\,x-320=\boxed{(2\,x+5)(x+8)(x-8)}$$

Feedback(*`attempt`*): *You want to factor by grouping, so you want to group up terms into pairs and then factor out any common terms from each pair. For example, if you had* $9x^3+8x^2-144x-128$ *then you could group it as* $(9x^3+8x^2)+(-144x-128)$*, then factor out any common factors in each group;* $x^2(9x+8)+-16(9x+8)$*, then pull out the common term in the parentheses (only works if they are the same!) to get* $(9x+8)(x^2-16)$*. This isn't the end though; you need to fully factor, so you need to check both terms to see if either is factorable, in this case* (x^2-16) *is factorable to* $(x-4)(x+4)$ *which gets you* $(9x+8)(x-4)(x+4)$ *as your final factoring.*

Problem 4 *Factor the following polynomial:*

$$4\,x^3+2\,x^2-196\,x-98=\boxed{(4\,x+2)(x+7)(x-7)}$$

Feedback(*`attempt`*): *You want to factor by grouping, so you want to group up terms into pairs and then factor out any common terms from each pair. For example, if you had* $9x^3+8x^2-144x-128$ *then you could group it as* $(9x^3+8x^2)+(-144x-128)$*, then factor out any common factors in each group;* $x^2(9x+8)+-16(9x+8)$*, then pull out the common term in the parentheses (only works if they are the same!) to get* $(9x+8)(x^2-16)$*. This isn't the end though; you need to fully factor, so you need to check both terms to see if either is factorable, in this case* (x^2-16) *is factorable to* $(x-4)(x+4)$ *which gets you* $(9x+8)(x-4)(x+4)$ *as your final factoring.*

Problem 5 *Factor the following polynomial:*

$x^5+4\,x^4-29\,x^3-116\,x^2+100\,x+400=\boxed{(x+5)(x+4)(x+2)(x-2)(x-5)}$

Feedback(*`attempt`*): *You want to factor by grouping, so you want to group up terms into pairs and then factor out any common terms from each pair. For example, if you had* $9x^3+8x^2-144x-128$ *then you could group it as* $(9x^3+8x^2)+(-144x-128)$*, then factor out any common factors in each group;* $x^2(9x+8)+-16(9x+8)$*, then pull out the common term in the parentheses (only works if they are the same!) to get* $(9x+8)(x^2-16)$*. This isn't the end though; you need to fully factor, so you need to check both terms to see if either is factorable, in this case* (x^2-16) *is factorable to* $(x-4)(x+4)$ *which gets you* $(9x+8)(x-4)(x+4)$ *as your final factoring.*
