CZ3106 Symbolic Computing, Tutorial 2

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1. Indicate the responses of Mathematica when the following expressions are entered, assuming that each expression is given to a fresh Mathematica session so that each subquestion is independent of the other subquestions.

(1) `(a+b*c)[[2,2]]`
(2) `x=1; y=2+x; x=2; y`
(3) `f @@ {a, b}`
(4) `Map[f, g[a,b]]`
(5) `f[f[f[x]]] //. f[x] -> x`
(6) `Fold[f, x, {a,b,c}]`
(7) `a=1;b=a+1;?b`
(8) `?*X*`
(9) `{1,2,3}^2`
(10) `f[x]:=x^2; f[y_]:=y^3; f[x]+f[y]`
(11) `Sqrt[#]& [4]`
(12) `2 // f`
(13) `MatchQ[f[a^x], f[x^x_]]`
(14) `Head[I]`
(15) `b :=a+1; a=2; ?b`
(16) `Precision[Pi]`

2. This problem tests your understanding of Mathematica syntax and semantics. Indicate the responses of Mathematica when the following expressions are entered, assuming that each expression is given to a fresh Mathematica session so that there should be no side effect among subquestions.

(1) `{1,2,3}// f`
(2) `f @@ {1,2,3}`
(3) `FullForm[x^3 + u*y]`
(4) `x //.  x -> x`
(5) `Head[x] == "Symbol"`
(6) `MatchQ[f[a,b], f[x__]]`
(7) `p || (q && !q)`
(8) `a = 1; a + 2`
(9) `{{a,b},{c,d}}.{1,2}`
(10) `Map[ #^2&, x+y+x]`
(11) `Log /@ {E, E^2, 1}`
(12) `Sum[1, {5}]`
(13) `Union[{a,a,b}]`
(14) `Expand[(1+x)^2] >> tmp`
(15) `x=2; y==x`
(16) `f[x_] := x^3; f[2]`

3. After specifying the following assignments and rules,

```
f[2] = 3;
f[u] := 2u^2;
f[v_] := 1/v;
u = 2
```

what is `f[u]`.

4. Define a set of Mathematica functions for vector calculus, i.e., $\nabla \cdot \mathbf{A}$, $\nabla \times \mathbf{A}$, ∇f, $\nabla^2 f$. The definition should be as general as possible.