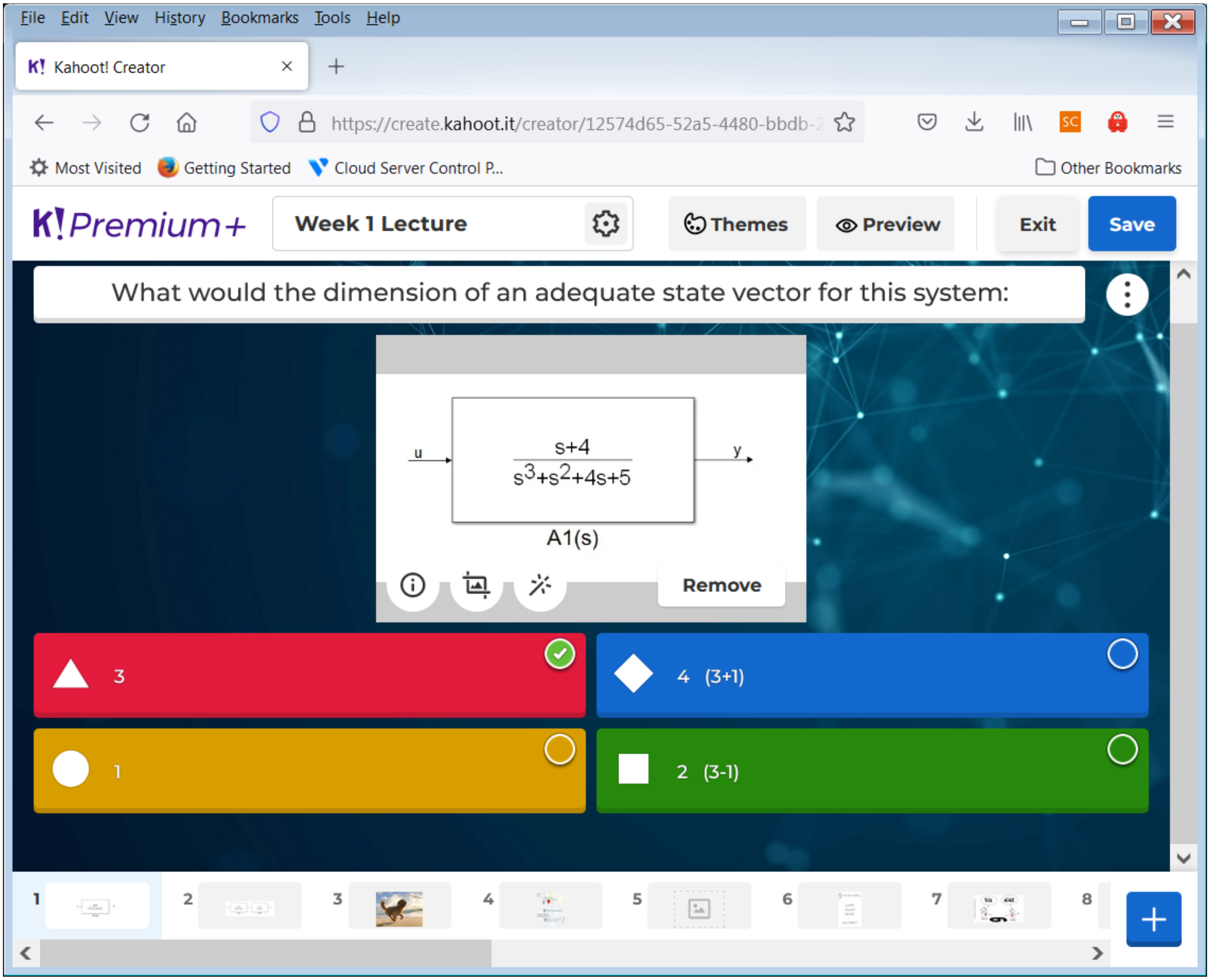
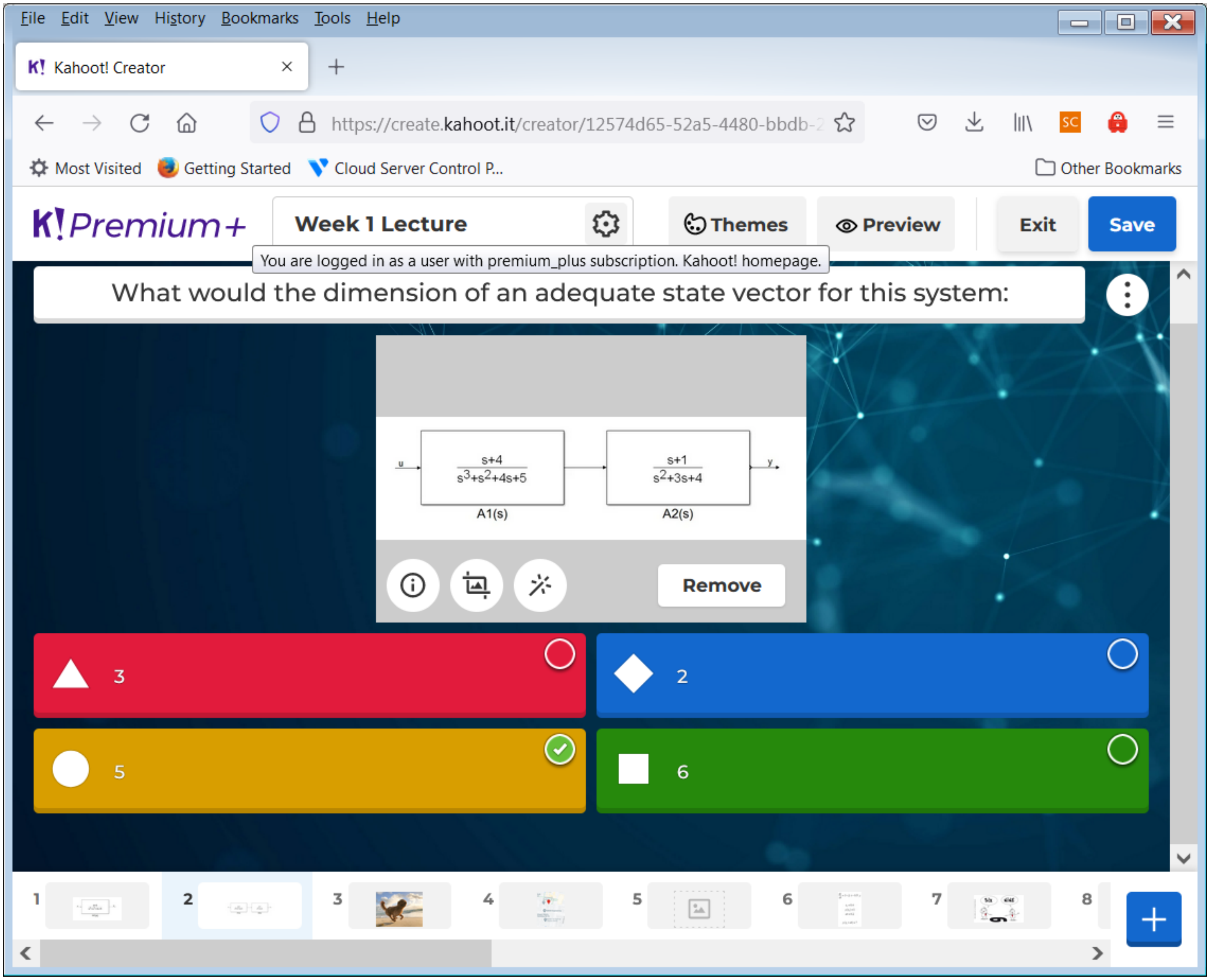
Answers to Kahoot questions, which we had in Lecture 1.



Dim=3. The Transfer function corresponds to a system of order 3 (denominator of TF has order 3). Consequently, the dimension of the state vector is, at least, 3. An adequate selection of states, would have such dimension.

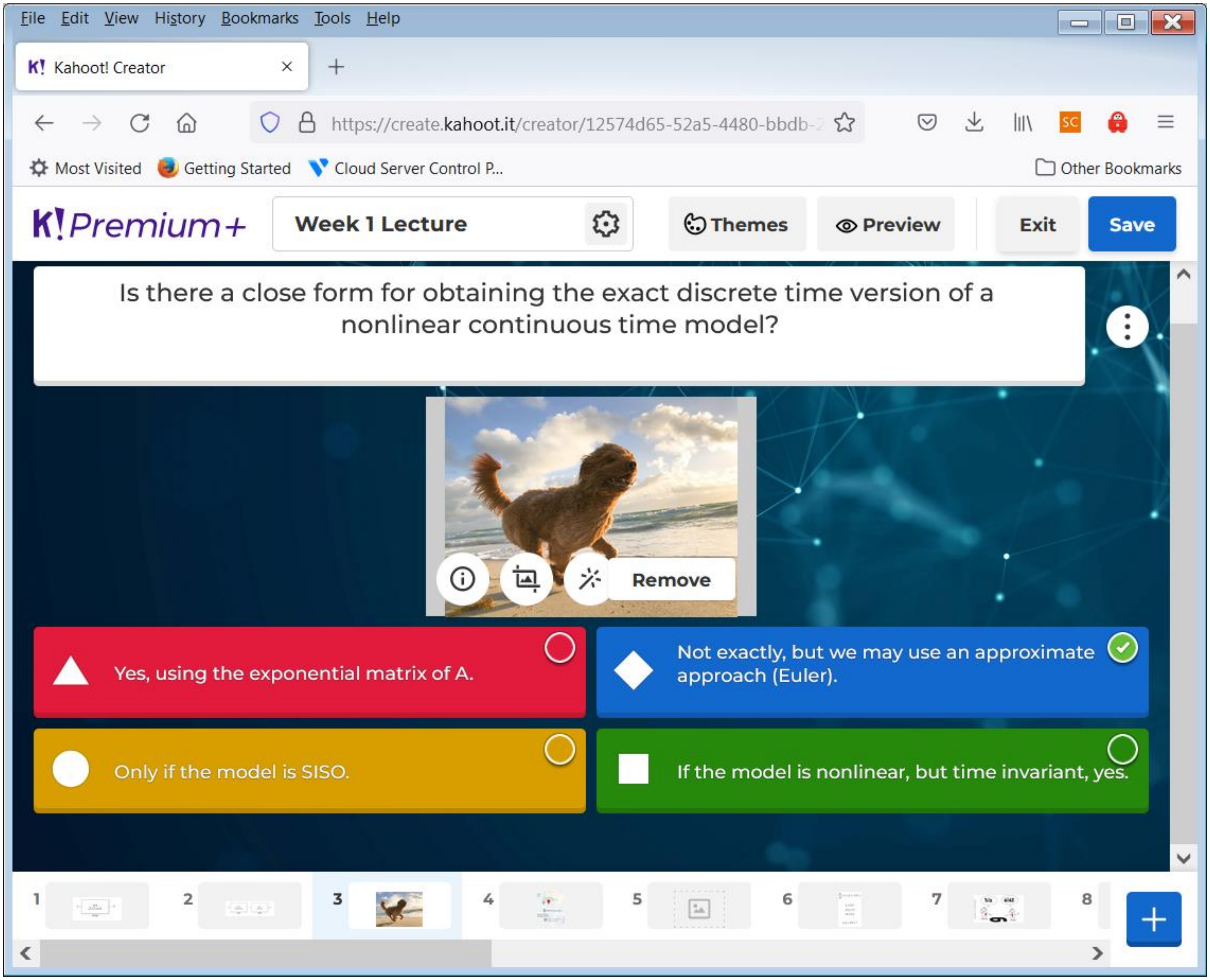
(note: The associated ODE for this TF is order 3).



Dim =5. The Transfer function of this system is of order 5 (you may infer it by considering the order of the denominator of the resulting TF (you do not need to obtain that TF, but just infer the order of its denominator).

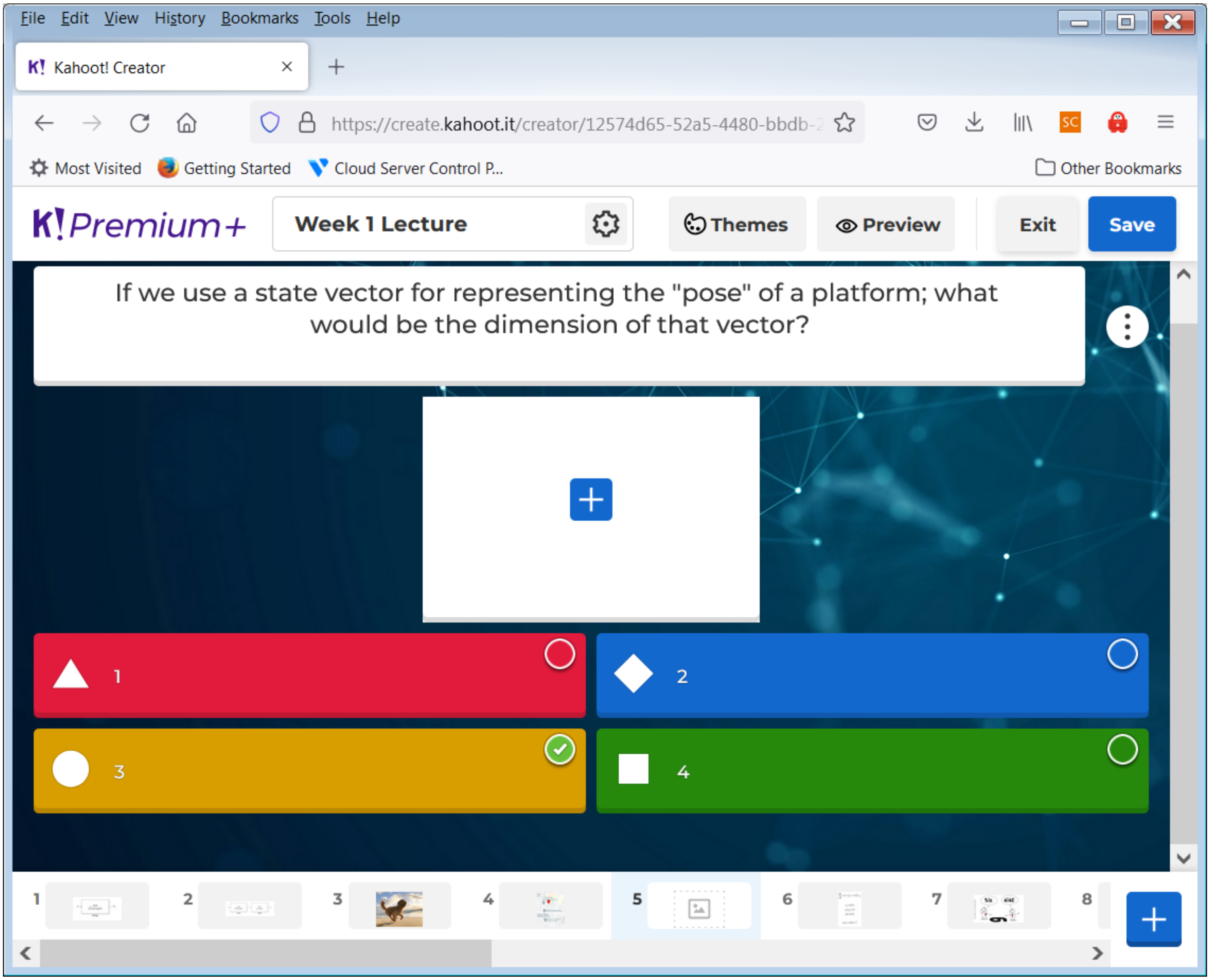
note: This question may be tricky, as it may trigger a doubts about “is there any cancellation zero/pole, so that the actual order would be lower? However, that is not the case in this case (just obtain the roots of numerators and denominators of A1(s) and A2(s)).

In addition, from the perspective of discussing about the internal state of a system, a cancellation pole/zero deserves a discussion, which is not in the spirit of this question in MTRN4010.

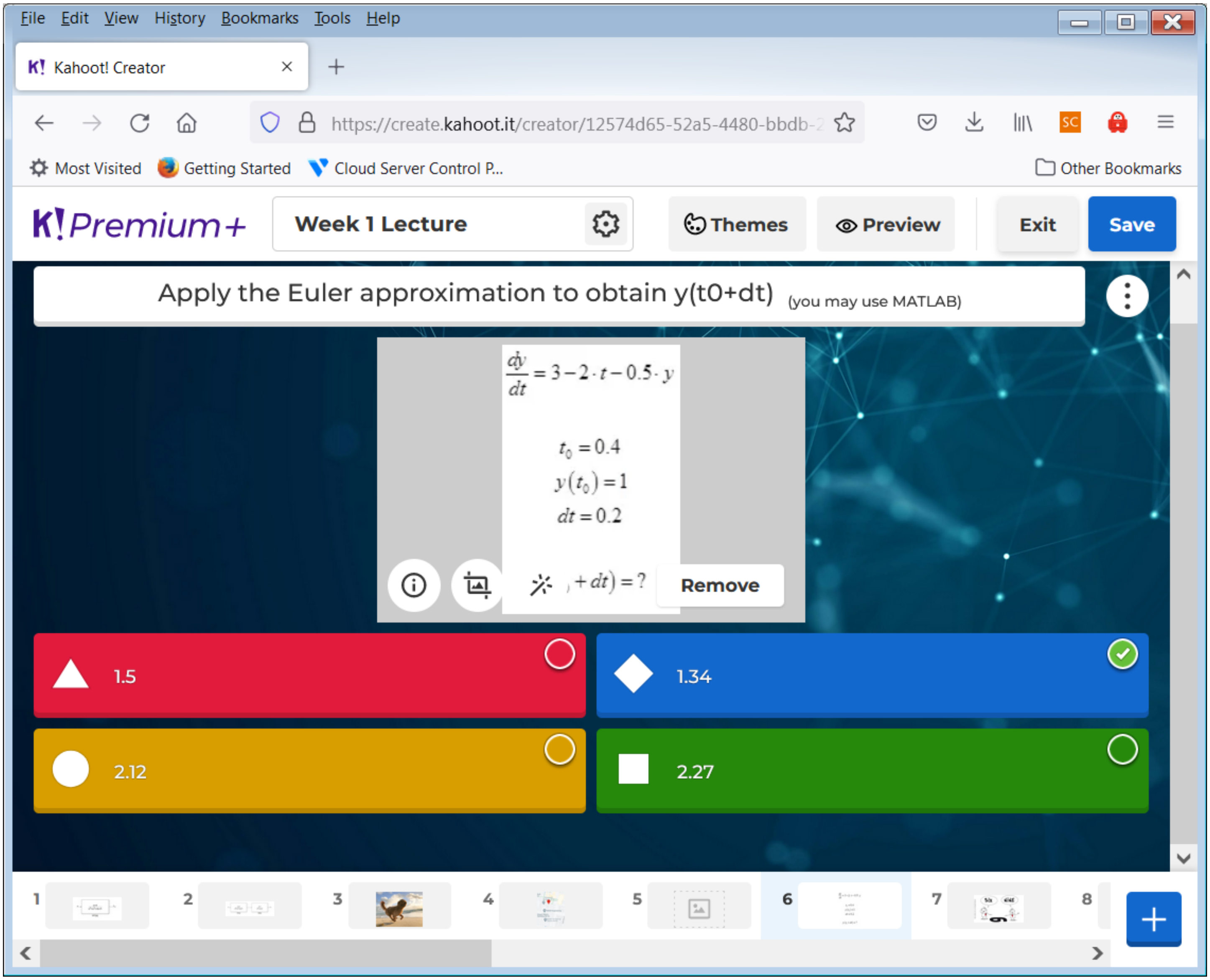


The question specifies "nonlinear system". 3 of the four options were made to sound serious, but are missing the point. If the model is nonlinear, there is no "close form" for obtaining the discrete time version of the model. So, we use the Euler approximation, which, for a "short enough dt", would do a good job.

(The picture showed a dog, because dogs are usually highly nonlinear…..)



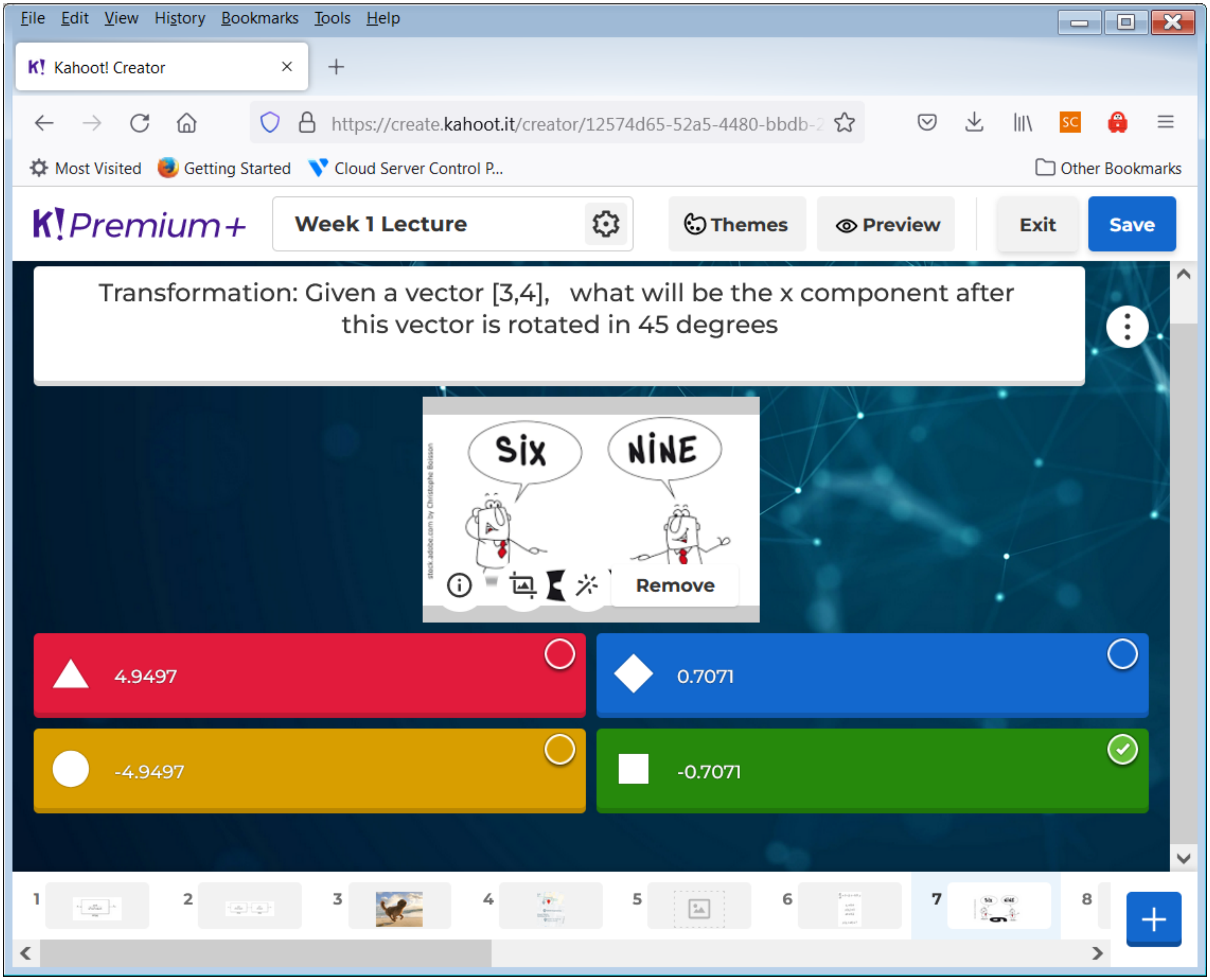
The pose is composed by Position and orientation. In 2D, position is 2D, and the orientation is just the heading (scalar, 1D). So that the full vector is 3D (x, y ,heading). That was the sate we had defined when we discussed the example involving the kinematic model of a car (which will be discussed and used, in more detail in week 2.).



We apply the Euler approximation (assuming that dt=0.2 seconds is "small enough". Actually, for this example, that dt is not "small enough"; however, if we had specified a better case like such as dt=0.02, the resulting numbers would have been difficult to appreciate or compare for our brains.

The Euler approximation is: y(t0+dt)=y(t0)+dt* f(y0,t0). a possible quick implementation would be:

```
t0=0.4;   y0=1;   %y(t0)
dt=0.2;
dydt = 3-2*t0-0.5*y0; %dy/dt(t0) = f(y0,t0)
y1 = y0+dydt*dt;   % y(t0+dt)
disp(y1);
% if I did not incur in any mistake!
% note: this may be a dt which is too large!
% not a "small enough" one
```




```
% possible quick implementation could be:

    p=[3;4]; % (I use column vectors)

    a = 45; a=a*pi/180;
    S=sin(a); C=cos(a); R = [[ C,-S]; [ S,C]];
    pb = R*p;

    disp(pb);
```