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(* Quiz 26 | AP Calculus BC | Shubleka *)

(* Problem 1 | A Period *)
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In[7]:=
```
f[x_] := (a^x) / (1 + a^(x + k));
```

In[8]:=
```
Simplify[f'[x]]
```

Out[8]= $\frac{a^x \text{Log}[a]}{\left(1 + a^{k+x}\right)^2}$

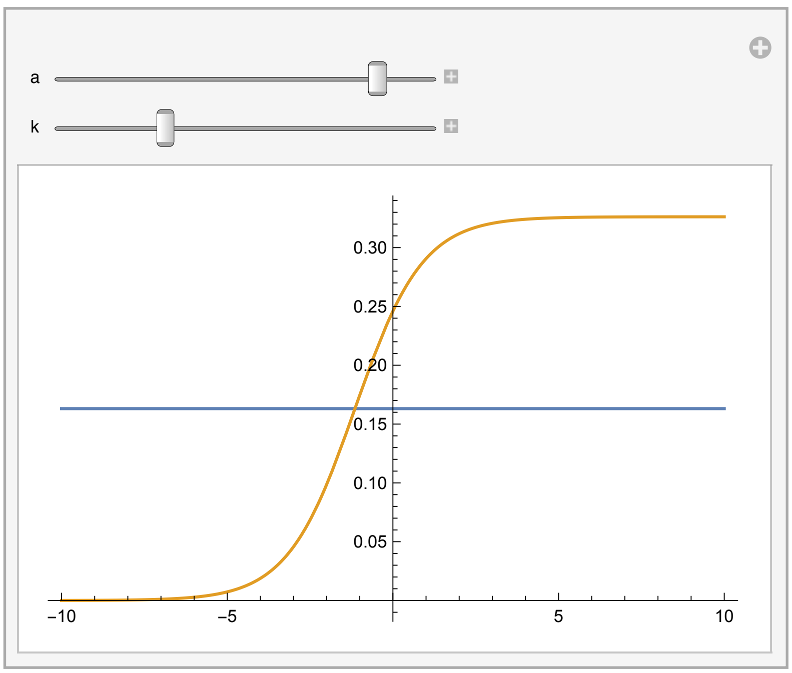
In[9]:=
```
Simplify[f''[x]]
```

Out[9]= $-\frac{a^x \left(-1 + a^{k+x}\right) \text{Log}[a]^2}{\left(1 + a^{k+x}\right)^3}$

The second derivative changes sign when x + k = 0, or equivalently, when x = -k.
Note that the first derivative does not change sign and the original function is continuous everywhere.

In[13]:=
```
Manipulate[Plot[{(a^-k) / (1 + a^(-k + k)), (a^x) / (1 + a^(x + k))}, {x, -10, 10}],
 {a, 0.1, 3}, {k, 0.1, 4}]
```

Out[13]=

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(* Problem 1 | F Period *)
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Differentiating both sides with respect to x, we get:
cos(x) - sin(y) y' = 2y'
cos(x) = y'(2+sin(y))
dy/dx = (cos x) / (2 + sin y)
As suggested by the problem, when cos x = 0 we have a critical point.
The second derivative is:

y''(x) =[(2+ sin y) (-sin x) - (cos x) (cos y) y'] / (2 + sin y)^2

When cos x = 0, the second derivative becomes:
y''(x) =[(2+ sin y) (-sin x)] / (2 + sin y)^2

at x = pi/2 + 2kPi, y"(x) < 0 , so we have a relative minimum.
at x=3pi/2 + 2kPi, y"(x) > 0, so we have a relative maximum.

In[19]:=
```
ContourPlot[{2 * y == Cos[y] + Sin[x], x == Pi / 2, x == 3 Pi / 2},
 {x, -2 Pi, 2 Pi}, {y, -1, 2}, Axes -> True]
```

Out[19]=