09.17.2014, Question 1: What is the equilibrium value of $\frac{dg}{dz} = -\frac{1}{2}g + 3e^z$?

(a) This system is at equilibrium when $g = 6e^z$.

(b) This system is at equlibrium when $z = \ln\left(\frac{g}{6}\right)$.

(c) Both a and b are true.

(d) This equation has no equlibrium.

D

An equilibrium value of *g'=f(g,z)* is a single value g* of the dependent variable g which causes *f(g,z)* to equal zero. It means that the solution *g(z)=g is an equilibrium solution of the ODE.**

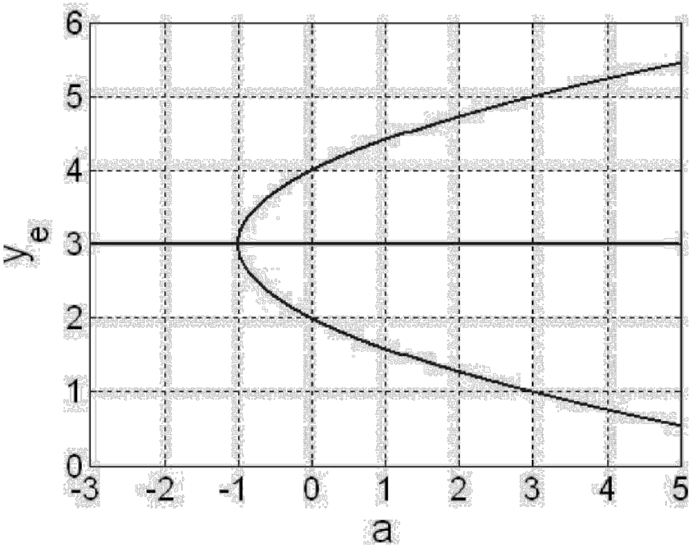
09.17.2014, Question 2: How many equilibria does the DE $y' = y^2 + a$ have?

A. Zero.
B. One.
C. Two.
D. Three.
E. Not Enough Information Is Given.

E

You should recognize this ODE as having a saddle-nose bifurcation at *a=0.* In other words, depending on values of *a* there could be 2 (*a*<*0*) or 1 (*a=0*) or no equilibrium values (*a*>*0*).

09.17.2014, Question 3: Consider the bifurcation diagram below. If the DE has equilibria at ***y=1, y=3***, and ***y=5*** what is the value of the bifurcation parameter **a**?



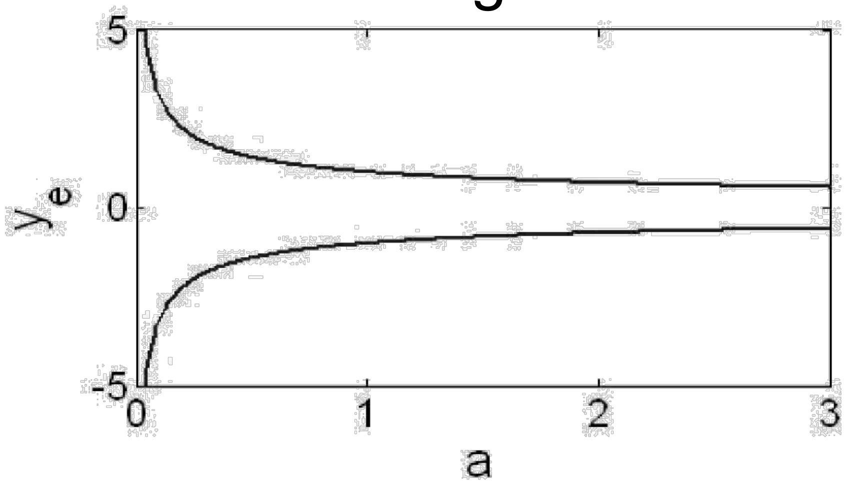
A. a=-1
B. a=0
C. a=1
D. a=3
E. Not Enough Information Is Given.

D

When the bifurcation parameter *a* equals 3 then there are three equilibria (At 1,3 and 5). The question is NOT asking you about the bifurcation value of the system, which in thus case would be *a=0.*

09.17.2014, Question 4: Which of the following diferential equations is represented by the bifurcation diagram below?

B



(a) $y' = y^2 + a$

(b) $y' = ay^2 - 1$

(c) $y' = ay$

(d) $y' = y^2 + ay + 2$

We can eliminate (a) and (c) since we know what bifurcation diagrams for those DEs would look like. Solving 0=*ay^2-1* means *y^2=1/a or y*=-1/sqrt(a)* and *y*=1/sqrt(a)* which have the properties of the given curves in the figure (as *a-->0,y* goes to infinity)*