

**Question 1:** Which of the following differential equations is **NOT** separable?

(a)  $y' = 3 \sin x \cos y$

(b)  $y' = x^2 + 3y$

(c)  $y' = e^{2x+y}$

(d)  $y' = 4x + 7$

(e) More than one of the above

**Question 2:** If we separate the variables in the differential equation  $3tz' = z^2$ , you should get

(a)  $3z^{-2}dz = t^{-1}dt$

(d)  $z = \sqrt{3z't}$

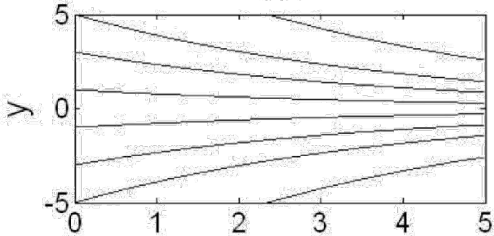
(b)  $3tdt = z^2dt$

(e) This equation cannot be separated.

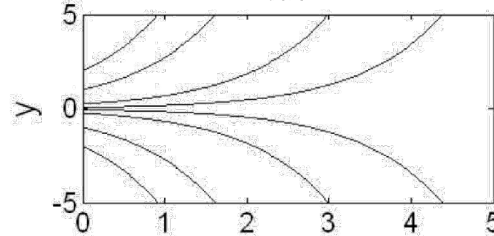
(c)  $3z'tdz = z^2dt$

**Question 3:** Each of the following graphs represents solution curves to  $y' = ky$ . Order the constants  $k$  from smallest to largest.

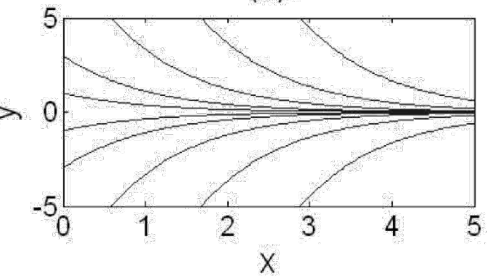
(a)



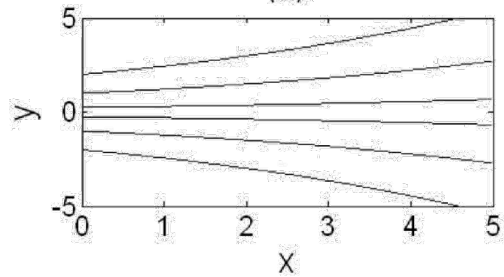
(b)



(c)



(d)



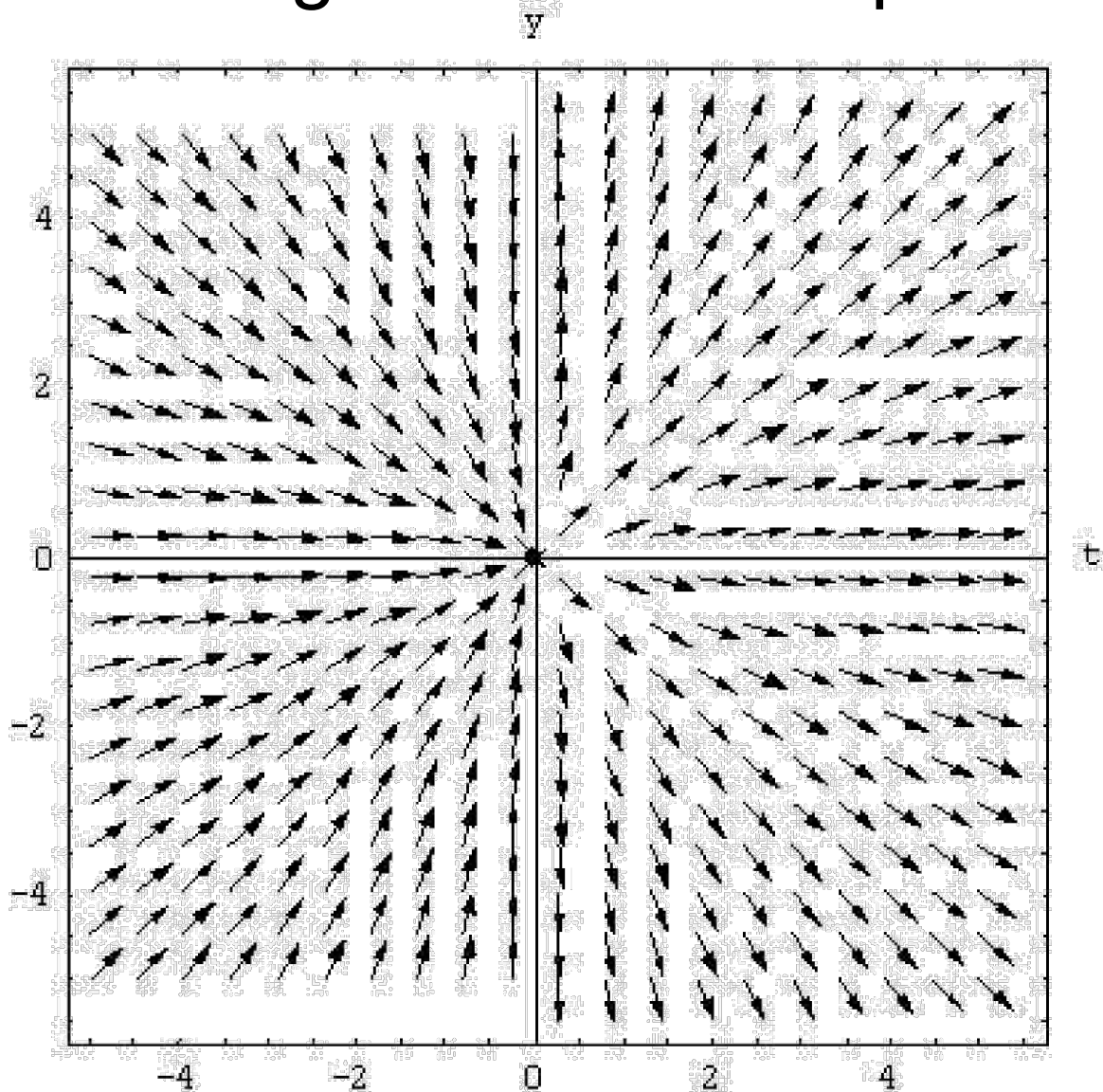
(a)  $k_b < k_d < k_a < k_c$

(b)  $k_d < k_c < k_b < k_a$

(c)  $k_c < k_a < k_d < k_b$

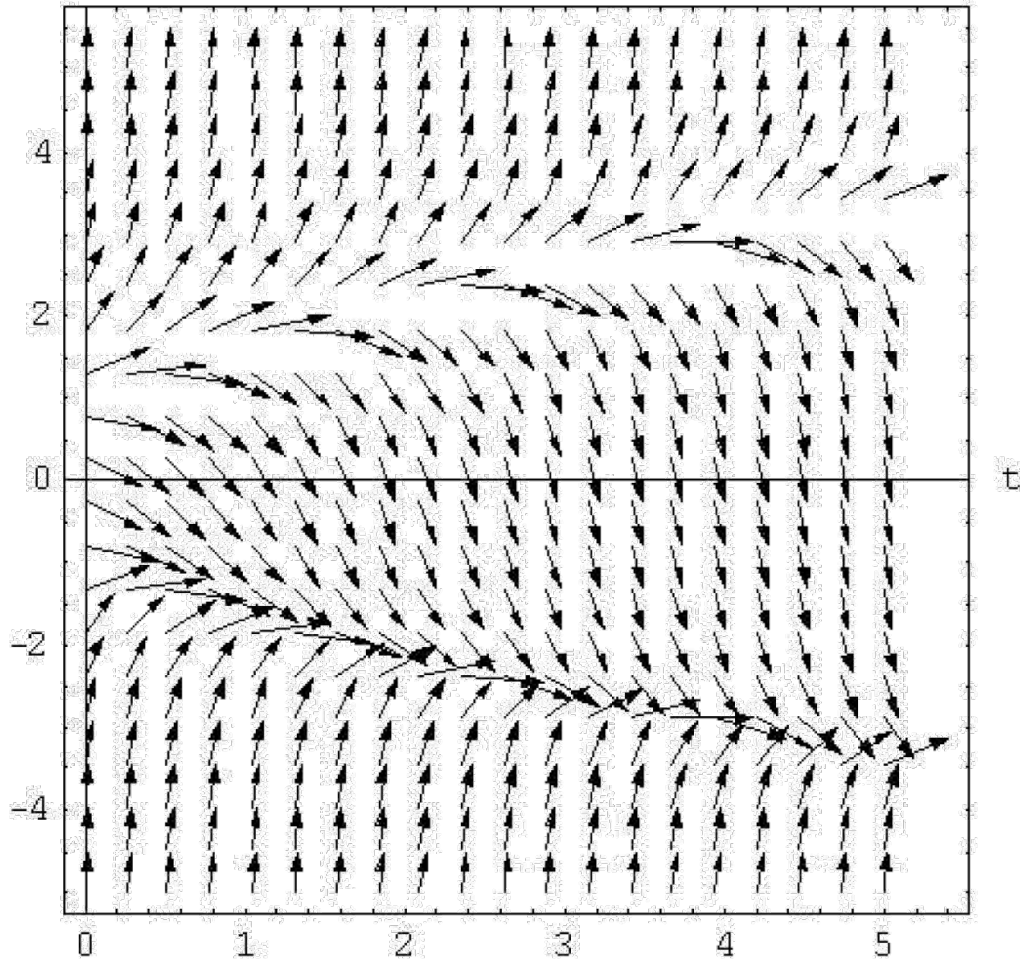
(d)  $k_a < k_b < k_c < k_d$

**Question 4:** Which of the following DEs would generate the slope field below?



- A.  $y' = yt$
- B.  $y' = y/t$
- C.  $y' = -yt$
- D.  $y' = -y/t$

**Question 5:** Consider the slope field which shows the derivative  $y'$  for a range of values for the function  $y$  and independent variable  $t$ . Suppose  $y(0) = -4$ . Predict  $y(5)$ .



- (a)  $y(5) \approx -3$
- (b)  $y(5) \approx +3$
- (c)  $y(5) \approx 0$
- (d)  $y(5) < -5$
- (e) None of the above

**Question 6:** Using Euler's Method, we obtain the difference equation  $y_{n+1}=y_n+c\Delta t$  to approximate a differential equation. What is the ODE being estimated?

A.  $y'=cy$

B.  $y'=y+c$

C.  $y'=c$

D.  $y'=y+c\Delta t$

E. None of the above

**Question 7:** Consider the differential equation  $y' = ay + b$  with parameters  $a$  and  $b$ . To approximate this differential equation using Euler's Method, what is the difference equation?

(a)  $y_{n+1} = ay_n + b$

(b)  $y_{n+1} = y_n + ay_n\Delta t + b\Delta t$       (d)  $y_{n+1} = y_n\Delta t + ay_n\Delta t + b\Delta t$

(c)  $y_{n+1} = ay_n\Delta t + b\Delta t$

(e) None of the above

**Question 8:** We have used Euler's Method to approximate the solution to a differential equation with the difference equation  $z_{n+1} = 1.2z_n$ . We know that the function  $z(0) = 3$ . Estimate  $z(2)$ .

- (a)  $z(2) \approx 3.6$       (c)  $z(2) \approx 5.184$   
(b)  $z(2) \approx 4.32$       (d) Not enough information is given.