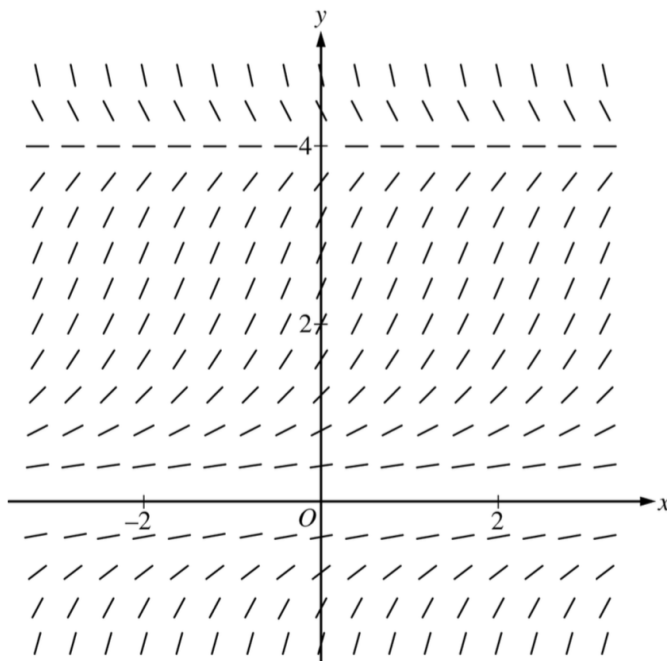


**Exam 11**  
**Differential and Slope Field**  
**MC Review Packet**  
**No Calculator**

Name \_\_\_\_\_



13. Shown above is a slope field for which of the following differential equations?

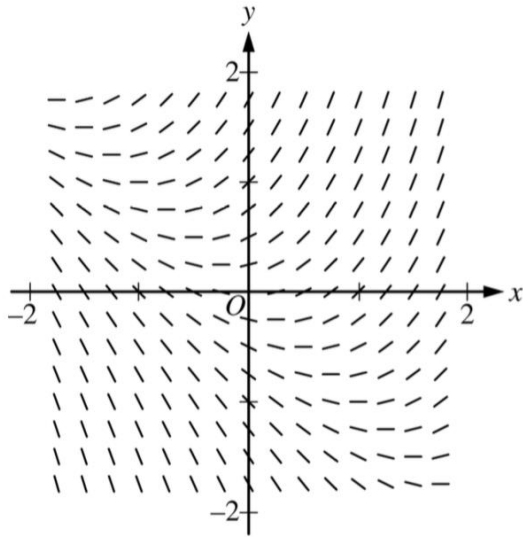
- (A)  $\frac{dy}{dx} = \frac{x(4 - y)}{4}$
- (B)  $\frac{dy}{dx} = \frac{y(4 - y)}{4}$
- (C)  $\frac{dy}{dx} = \frac{xy(4 - y)}{4}$
- (D)  $\frac{dy}{dx} = \frac{y^2(4 - y)}{4}$

14. The weight of a population of yeast is given by a differentiable function  $y$ , where  $y(t)$  is measured in grams and  $t$  is measured in days. The weight of the yeast population increases according to the equation  $\frac{dy}{dt} = ky$ , where  $k$  is a constant. At time  $t = 0$ , the weight of the yeast population is 120 grams and is increasing at the rate of 24 grams per day. Which of the following is an expression for  $y(t)$  ?

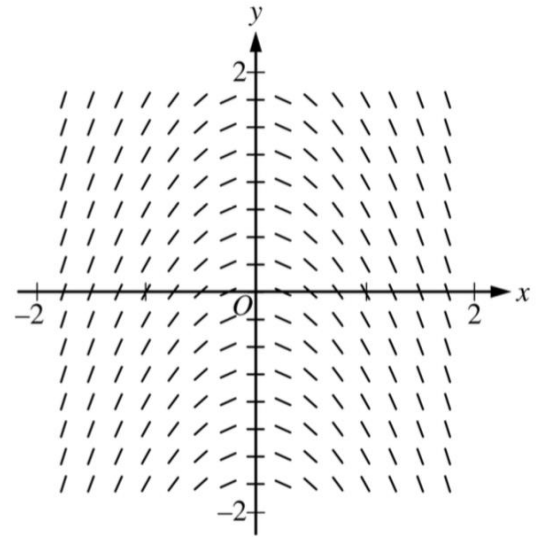
- (A)  $120e^{24t}$
- (B)  $120e^{t/5}$
- (C)  $e^{t/5} + 119$
- (D)  $24t + 120$

16. Which of the following could be a slope field for the differential equation  $\frac{dy}{dx} = x^2 + y$  ?

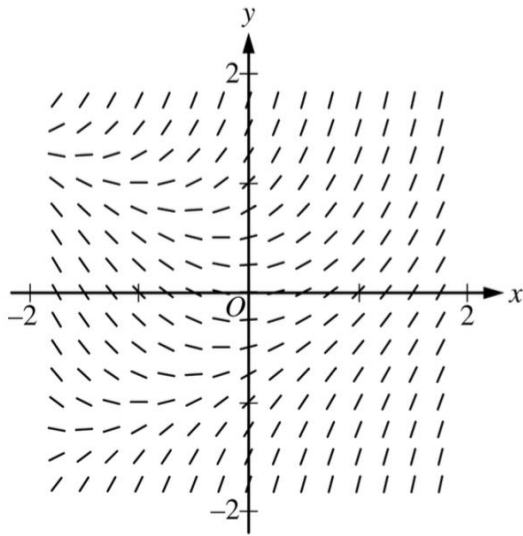
(A)



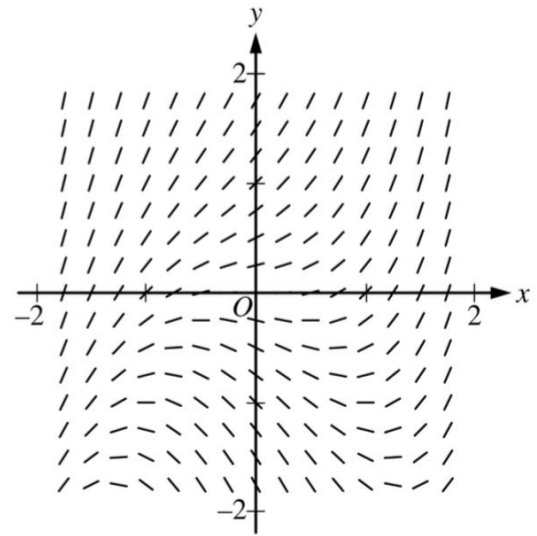
(B)



(C)



(D)



22. Let  $y = f(x)$  be the particular solution to the differential equation  $\frac{dy}{dx} = \frac{x+1}{y}$  with the initial condition  $f(0) = -2$ . Which of the following is an expression for  $f(x)$  ?

(A)  $-2 - \sqrt{x^2 + 2x}$

(B)  $-2 + \sqrt{x^2 + 2x}$

(C)  $-\sqrt{x^2 + 2x + 4}$

(D)  $\sqrt{x^2 + 2x + 4}$

14. If  $y = f(x)$  is a solution to the differential equation  $\frac{dy}{dx} = e^{x^2}$  with the initial condition  $f(0) = 2$ , which of the following is true?

(A)  $f(x) = 1 + e^{x^2}$

(B)  $f(x) = 2xe^{x^2}$

(C)  $f(x) = \int_1^x e^{t^2} dt$

(D)  $f(x) = 2 + \int_0^x e^{t^2} dt$

(E)  $f(x) = 2 + \int_2^x e^{t^2} dt$

18. A student attempted to solve the differential equation  $\frac{dy}{dx} = xy$  with initial condition  $y = 2$  when  $x = 0$ . In which step, if any, does an error first appear?

Step 1:  $\int \frac{1}{y} dy = \int x dx$

Step 2:  $\ln |y| = \frac{x^2}{2} + C$

Step 3:  $|y| = e^{x^2/2} + C$

Step 4: Since  $y = 2$  when  $x = 0$ ,  $2 = e^0 + C$ .

Step 5:  $y = e^{x^2/2} + 1$

(A) Step 2

(B) Step 3

(C) Step 4

(D) Step 5

(E) There is no error in the solution.

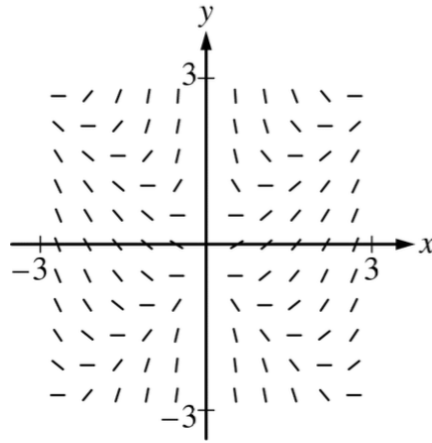
3. Let  $f$  be a differentiable function such that  $f(2) = 4$  and  $f'(2) = -\frac{1}{2}$ . What is the approximation for  $f(2.1)$  found by using the line tangent to the graph of  $f$  at  $x = 2$  ?

(A) 2.95

(B) 3.95

(C) 4.05

(D) 4.1



13. Shown above is a slope field for which of the following differential equations?

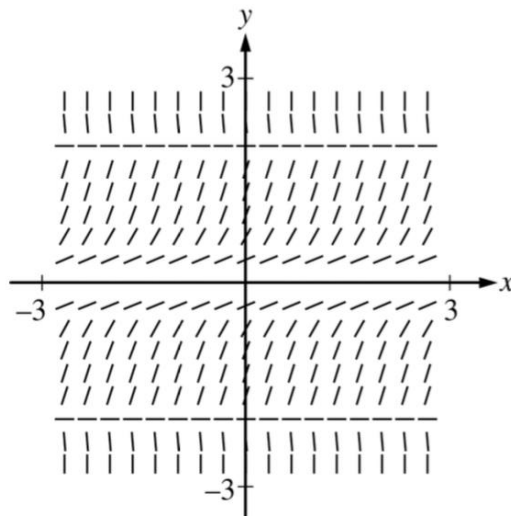
(A)  $\frac{dy}{dx} = \frac{x^2 - y^2}{x}$

(B)  $\frac{dy}{dx} = \frac{x^2 - y^2}{y}$

(C)  $\frac{dy}{dx} = x^2 - y^2$

(D)  $\frac{dy}{dx} = \frac{x^2 + y^2}{x}$

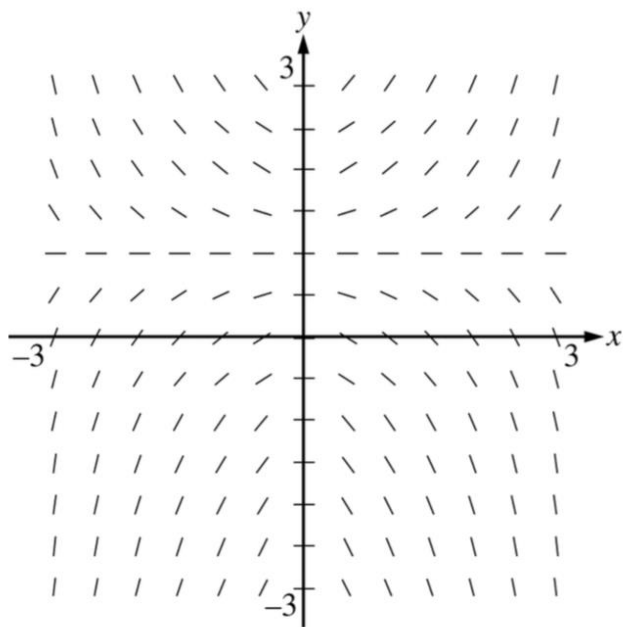
(E)  $\frac{dy}{dx} = x^2 + y^2$



8. Shown above is a slope field for the differential equation  $\frac{dy}{dx} = y^2(4 - y^2)$ . If  $y = g(x)$  is the solution to the differential equation with the initial condition  $g(-2) = -1$ , then  $\lim_{x \rightarrow \infty} g(x)$  is

- (A)  $-\infty$       (B)  $-2$       (C)  $0$       (D)  $2$       (E)  $3$

24. Which of the following is the solution to the differential equation  $\frac{dy}{dx} = 5y^2$  with the initial condition  $y(0) = 3$  ?
- (A)  $y = \sqrt{9e^{5x}}$
- (B)  $y = \sqrt{\frac{1}{9}e^{5x}}$
- (C)  $y = \sqrt{e^{5x} + 9}$
- (D)  $y = \frac{3}{1 - 15x}$
- (E)  $y = \frac{3}{1 + 15x}$
23. What is the particular solution to the differential equation  $\frac{dy}{dx} = xy^2$  with the initial condition  $y(2) = 1$  ?
- (A)  $y = e^{\frac{x^2}{2}-2}$
- (B)  $y = e^{\frac{x^2}{2}}$
- (C)  $y = -\frac{2}{x^2}$
- (D)  $y = \frac{2}{6 - x^2}$
- (E)  $y = \frac{6 - x^2}{2}$
24. Which of the following is the solution to the differential equation  $\frac{dy}{dx} = -2xy$  with the initial condition  $y(1) = 4$  ?
- (A)  $y = e^{x^2} + 4 - e$
- (B)  $y = e^{-x^2} + 4 - \frac{1}{e}$
- (C)  $y = 4e^{x^2-1}$
- (D)  $y = 4e^{-x^2+1}$
- (E)  $y = e^{-x^2+16}$



28. Shown above is a slope field for which of the following differential equations?

(A)  $\frac{dy}{dx} = xy - x$

(B)  $\frac{dy}{dx} = xy + x$

(C)  $\frac{dy}{dx} = y - x^2$

(D)  $\frac{dy}{dx} = (y - 1)x^2$

(E)  $\frac{dy}{dx} = (y - 1)^3$

13. If  $y^3 + y = x^2$ , then  $\frac{dy}{dx} =$

(A) 0      (B)  $\frac{x}{2}$       (C)  $\frac{2x}{3y^2}$       (D)  $2x - 3y^2$       (E)  $\frac{2x}{1 + 3y^2}$

18. If  $\ln(2x + y) = x + 1$ , then  $\frac{dy}{dx} =$

(A) -2      (B)  $2x + y - 2$       (C)  $2x + y$       (D)  $4x + 2y - 2$       (E)  $y - \frac{y}{x}$

25. Which of the following is the solution to the differential equation  $\frac{dy}{dx} = e^{y+x}$  with the initial condition  $y(0) = -\ln 4$  ?

(A)  $y = -x - \ln 4$

(B)  $y = x - \ln 4$

(C)  $y = -\ln(-e^x + 5)$

(D)  $y = -\ln(e^x + 3)$

(E)  $y = \ln(e^x + 3)$

23. If  $P(t)$  is the size of a population at time  $t$ , which of the following differential equations describes linear growth in the size of the population?

(A)  $\frac{dP}{dt} = 200$

(B)  $\frac{dP}{dt} = 200t$

(C)  $\frac{dP}{dt} = 100t^2$

(D)  $\frac{dP}{dt} = 200P$

(E)  $\frac{dP}{dt} = 100P^2$

25. Which of the following is the solution to the differential equation  $\frac{dy}{dx} = 2 \sin x$  with the initial condition  $y(\pi) = 1$  ?

(A)  $y = 2 \cos x + 3$

(B)  $y = 2 \cos x - 1$

(C)  $y = -2 \cos x + 3$

(D)  $y = -2 \cos x + 1$

(E)  $y = -2 \cos x - 1$

27. If  $(x + 2y) \cdot \frac{dy}{dx} = 2x - y$ , what is the value of  $\frac{d^2y}{dx^2}$  at the point  $(3, 0)$ ?

- (A)  $-\frac{10}{3}$       (B) 0      (C) 2      (D)  $\frac{10}{3}$       (E) Undefined

16. If  $\sin(xy) = x$ , then  $\frac{dy}{dx} =$

(A)  $\frac{1}{\cos(xy)}$

(B)  $\frac{1}{x \cos(xy)}$

(C)  $\frac{1 - \cos(xy)}{\cos(xy)}$

(D)  $\frac{1 - y \cos(xy)}{x \cos(xy)}$

(E)  $\frac{y(1 - \cos(xy))}{x}$

18. In the  $xy$ -plane, the line  $x + y = k$ , where  $k$  is a constant, is tangent to the graph of  $y = x^2 + 3x + 1$ . What is the value of  $k$ ?

- (A) -3      (B) -2      (C) -1      (D) 0      (E) 1

23. Which of the following is the solution to the differential equation  $\frac{dy}{dx} = \frac{x^2}{y}$  with the initial condition  $y(3) = -2$ ?

(A)  $y = 2e^{-9+x^3/3}$

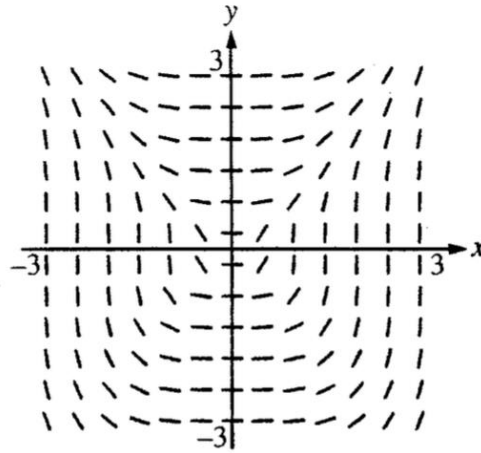
(B)  $y = -2e^{-9+x^3/3}$

(C)  $y = \sqrt{\frac{2x^3}{3}}$

(D)  $y = \sqrt{\frac{2x^3}{3} - 14}$

(E)  $y = -\sqrt{\frac{2x^3}{3} - 14}$



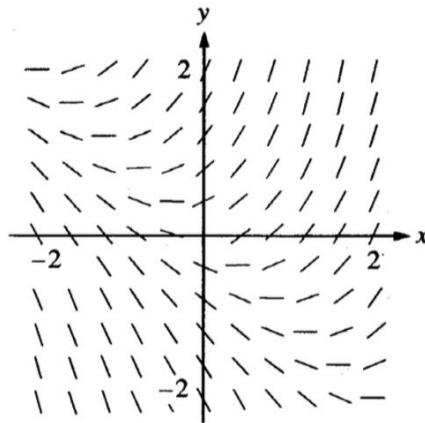


14. Shown above is a slope field for which of the following differential equations?

- (A)  $\frac{dy}{dx} = \frac{x}{y}$       (B)  $\frac{dy}{dx} = \frac{x^2}{y^2}$       (C)  $\frac{dy}{dx} = \frac{x^3}{y}$       (D)  $\frac{dy}{dx} = \frac{x^2}{y}$       (E)  $\frac{dy}{dx} = \frac{x^3}{y^2}$

18. If  $\frac{dy}{dt} = -10e^{-t/2}$  and  $y(0) = 20$ , what is the value of  $y(6)$ ?

- (A)  $20e^{-6}$       (B)  $20e^{-3}$       (C)  $20e^{-2}$       (D)  $10e^{-3}$       (E)  $5e^{-3}$



24. Shown above is a slope field for which of the following differential equations?

- (A)  $\frac{dy}{dx} = 1+x$       (B)  $\frac{dy}{dx} = x^2$       (C)  $\frac{dy}{dx} = x+y$       (D)  $\frac{dy}{dx} = \frac{x}{y}$       (E)  $\frac{dy}{dx} = \ln y$

21. If  $\frac{dy}{dt} = ky$  and  $k$  is a nonzero constant, then  $y$  could be

- (A)  $2e^{kty}$       (B)  $2e^{kt}$       (C)  $e^{kt} + 3$       (D)  $kty + 5$       (E)  $\frac{1}{2}ky^2 + \frac{1}{2}$

6. If  $x^2 + xy = 10$ , then when  $x = 2$ ,  $\frac{dy}{dx} =$

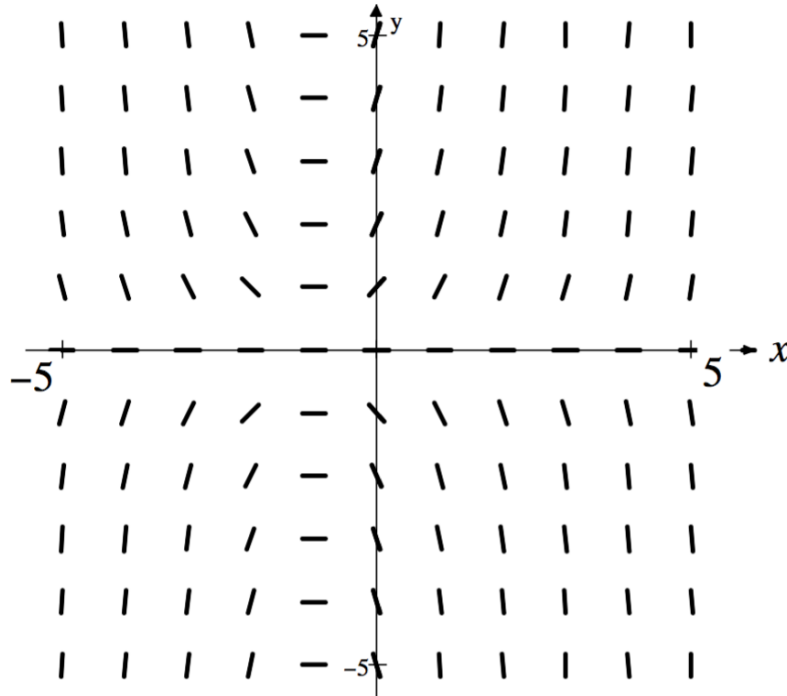
(A)  $-\frac{7}{2}$

(B)  $-2$

(C)  $\frac{2}{7}$

(D)  $\frac{3}{2}$

(E)  $\frac{7}{2}$



27. Shown above is a slope field for which of the following differential equations?

(A)  $\frac{dy}{dx} = xy$

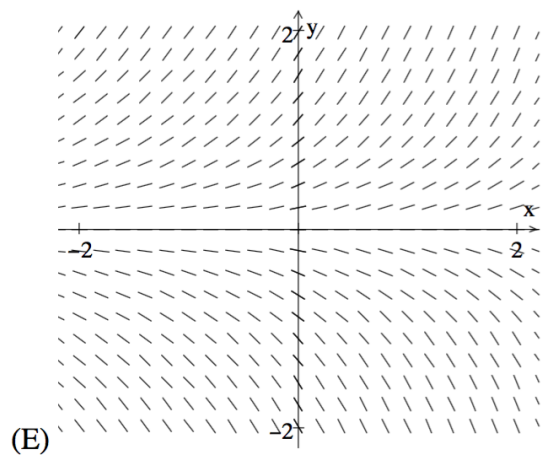
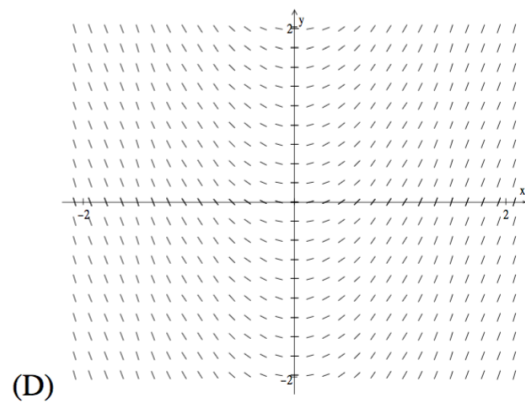
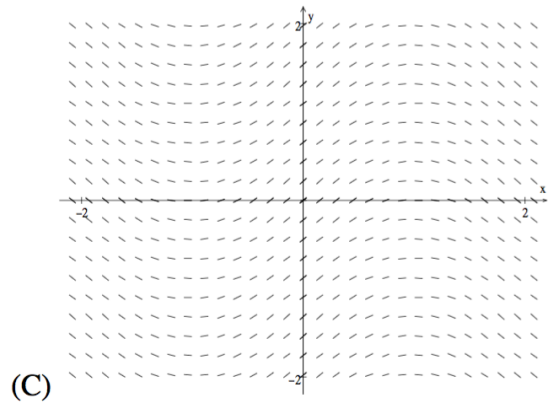
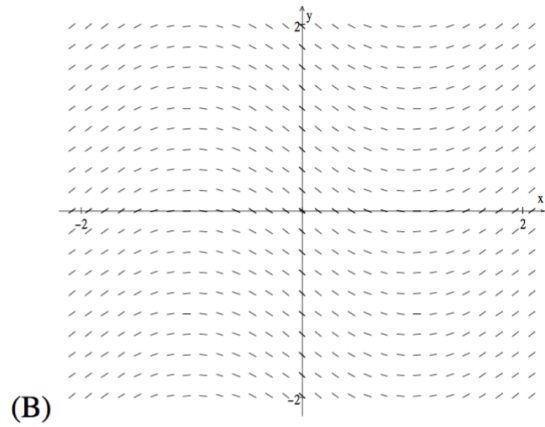
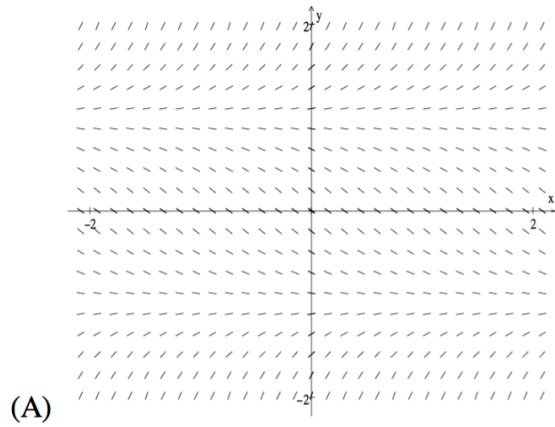
(B)  $\frac{dy}{dx} = xy - y$

(C)  $\frac{dy}{dx} = xy + y$

(D)  $\frac{dy}{dx} = xy + x$

(E)  $\frac{dy}{dx} = (x+1)^3$

27. Which of the following could be the slope field for the differential equation  $\frac{dy}{dx} = y^2 - 1$ ?



**Calculator Active**

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81. If  $\frac{dy}{dx} = \sqrt{1-y^2}$ , then  $\frac{d^2y}{dx^2} =$

- (A)  $-2y$       (B)  $-y$       (C)  $\frac{-y}{\sqrt{1-y^2}}$       (D)  $y$       (E)  $\frac{1}{2}$

84. Population  $y$  grows according to the equation  $\frac{dy}{dt} = ky$ , where  $k$  is a constant and  $t$  is measured in years. If the population doubles every 10 years, then the value of  $k$  is

- (A) 0.069      (B) 0.200      (C) 0.301      (D) 3.322      (E) 5.000

90. The population  $P$  of a city grows according to the differential equation  $\frac{dP}{dt} = kP$ , where  $k$  is a constant and  $t$  is measured in years. If the population of the city doubles every 12 years, what is the value of  $k$ ?

- (A) 0.058      (B) 0.061      (C) 0.167      (D) 0.693      (E) 8.318

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87. Which of the following is an equation of the line tangent to the graph of  $f(x) = x^4 + 2x^2$  at the point where  $f'(x) = 1$ ?

- (A)  $y = 8x - 5$   
(B)  $y = x + 7$   
(C)  $y = x + 0.763$   
(D)  $y = x - 0.122$   
(E)  $y = x - 2.146$

**Differential and Slope Field MC Review**  
**Answer Key**

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**Pg 1:** 13d, 14b

**Pg 2:** 16d, 22c

**Pg 3:** 14d, 18b, 3b

**Pg 4:** 13a, 8c

**Pg 5:** 26d, 23d, 24d

**Pg 6:** 28a, 13e, 18b

**Pg 7:** 25c, 23a, 25e

**Pg 8:** 27a, 16d, 18a, 23e

**Pg 9:** 14e, 18b, 24c, 21b

**Pg 10:** 6a, 27c

**Pg 11:** 27a

**Pg 12:** 81b, 84a, 90a, 87d