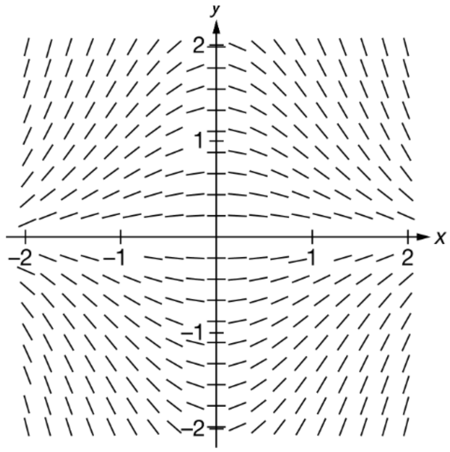
# Unit 4 AP Classroom Practice for Lessons 6-8

1)




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

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

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

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

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

2) What is the general solution to the differential equation $\frac{dy}{dx} = \frac{x-1}{3y^2}$ for $y > 0$?

(A) $y = \frac{1}{\left(-\frac{3}{2}x^2+3x+C\right)}$

(B) $y = \left(e^{\left(\frac{3x^2}{2}-3x+C\right)}\right)^{\frac{1}{2}}$

(C) $y = \left(x^2-x\right)^{\frac{1}{3}} + C$

(D) $y = \left(\frac{x^2}{2} - x + C\right)^{\frac{1}{3}}$

3) What is the general solution to the differential equation $\frac{dy}{dx} = \sqrt{y} - \sqrt{y}\sin x$ for $y > 0$ ?

Ⓐ $y = Ce^{2x+2\cos x}$

Ⓑ $y = \left(\frac{3}{2}(x + \cos x + C)\right)^{\frac{2}{3}}$

Ⓒ $y = \frac{1}{4}(x + \cos x)^2 + C$

Ⓓ $y = \frac{1}{4}(x + \cos x + C)^2$

4)

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

Ⓐ $y = \frac{e^{2x}-1}{2}$ for all $x$

Ⓑ $y = \tan x$ for $-\frac{\pi}{2} < x < \frac{\pi}{2}$

Ⓒ $y = \sqrt{x}$ for $x \geq 0$

Ⓓ $y = \frac{-1+\sqrt{1+4x}}{2}$ for $x > -\frac{1}{4}$

## 5) GRAPHING CALCULATOR NEEDED!

Let $f$ be the function given by $f(x) = \sin(2x)\cos(1+x)$. What is the average value of $f$on the closed interval $1 \leq x \leq 3$ ?

Ⓐ 0.739

Ⓑ 0.369

Ⓒ 0.281

Ⓓ $-0.098$

## 6)

The average value of a function $f$ over the interval $[-2,3]$ is $-6$, and the average value of $f$ over the interval $[3,5]$ is 20. What is the average value of $f$ over the interval $[-2,5]$ ?

(A) 2

(B) 7

(C) $\frac{10}{7}$

(D) 5

## 7)

The intensity of radiation at a distance $x$ meters from a source is modeled by the function $R$ given by $R(x) = \frac{k}{x^2}$, where $k$ is a positive constant. Which of the following gives the average intensity of radiation between 10 meters and 50 meters from the source?

(A) $\frac{k}{900}$

(B) $-\frac{k}{50} + \frac{k}{10}$

(C) $\frac{1}{40}\left(-\frac{k}{50} + \frac{k}{10}\right)$

(D) $\frac{1}{2}\left(\frac{k}{100} + \frac{k}{2500}\right)$

## 8) GRAPHING CALCULATOR NEEDED!

A cup of coffee is poured, and the temperature is measured to be 120 degrees Fahrenheit. The temperature of the coffee then decreases at a rate modeled by $r(t) = 55e^{-0.03t^2}$ degrees Fahrenheit per minute, where $t$ is the number of minutes since the coffee was poured. What is the temperature of the coffee, in degrees Fahrenheit, at time $t = 1$ minute?

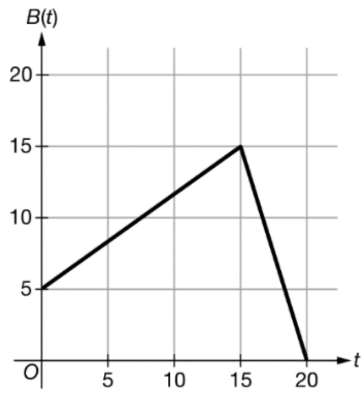
(A) $53.4^{\circ}\mathrm{F}$

(B) $54.5^{\circ}\mathrm{F}$

(C) $65.5^{\circ}\mathrm{F}$

(D) $66.6^{\circ}\mathrm{F}$

## 9)




The rate at which people arrive at a theater box office is modeled by the function $B$, where $B(t)$ is measured in people per minute and $t$ is measured in minutes. The graph of $B$ for $0 \le t \le 20$ is shown in the figure above. Which of the following is closest to the number of people that arrive at the box office during the time interval $0 \le t \le 20$ ?

(A) 15

(B) 38

(C) 150

(D) 188

## 10) Open Ended: GRAPHING CALCULATOR NEEDED!

Mary and Chance walk in the same direction along a straight path. For $0 \le t \le 20$, Mary's velocity at time $t$ is given by $M(t) = \frac{6010}{t^2-3t+50.5}$ and Chance's velocity at time $t$ is given by $C(t) = 8.5t^3e^{-0.45t}$. Both $M(t)$ and $C(t)$ are positive for $0 \le t \le 20$ and are measured in meters per minute, and $t$ is measured in minutes. Mary is 12 meters ahead of Chance at time $t = 0$, and Mary remains ahead of Chance for $0 < t \le 20$.

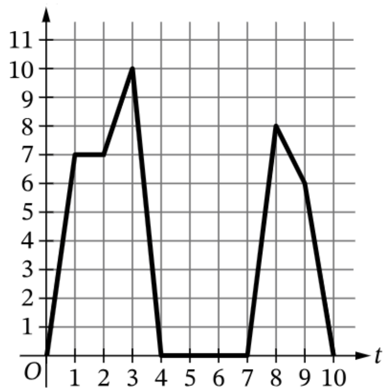
(a) Find the value of $\frac{1}{10}\int_5^{15} M(t)dt$. Using correct units, interpret the meaning of $\frac{1}{10}\int_5^{15} M(t)dt$ in the context of the problem.

(b) At time $t = 10$, is Mary speeding up or slowing down? Give a reason for your answer.

(c) Is the distance between Mary and Chance at time $t = 18$ increasing or decreasing? Give a reason for your answer.

(d) What is the maximum distance between Mary and Chance over the time interval $0 \le t \le 20$ ? Justify your answer.

11) The Iditarod dog sled race takes place annually in Alaska. The velocity of one dog sled, $v(t)$, measured in miles per hour, was tracked for a $10$-hour period from 12 p.m. ($t = 0$) to 10 p.m. ($t = 10$).




The graph of the dog sled's velocity during this $10$-hour time period is shown above.

**(a)** Using correct units, interpret the meaning of $\int_0^{10} v(t)\,dt$ in the context of this problem.

Find the value of $\int_0^{10} v(t)\,dt$. Describe how you found your answer.

**(b)** What is the average velocity of the dog sled on the interval $0 \le t \le 4$? Show work that leads to your answer.

**(c)** Assume positive velocity represents movement away from the dog's home. If the dog sled's position at 12 p.m. ($t = 0$) was 20 miles away from home, what would be its position at 10 p.m. ($t = 10$)? Show work that leads to your answer.