

# Office Hours:

## Instructor:

Peter M. Garfield

garfield@math.ucsb.edu

South Hall 6510

Tuesdays 1:30–2:30PM

Wednesdays 11AM–12PM

Thursdays ~~10:30–11:30AM~~ Not 2/14

Or by appointment

## TAs:

Christine Alar

christine@math.ucsb.edu

Tuesdays 1–2PM

South Hall 6431 U

Justin Rogers

justin\_rogers@math.ucsb.edu

Thursdays 2–3PM

South Hall 6432 V

Abe Schulte

aschulte@math.ucsb.edu

Thursdays 11AM–12PM

South Hall 6432 M

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# Summary of Logs

$\log(y)$  is how many tens you multiply together to get  $y$ .

	laws of exponents	corresponding law of logs
(1)	$10^a \times 10^b = 10^{a+b}$	$\log(xy) = \log(x) + \log(y)$
(2)	$10^0 = 1$	$\log(1) = 0$
(3)	$10^{-a} = 1/10^a$	$\log(1/x) = -\log(x)$
(4)	$(10^a)^p = 10^{ap}$	$\log(x^p) = p \log(x)$
(5)	$10^a/10^b = 10^{a-b}$	$\log(x/y) = \log(x) - \log(y)$

Each of these pairs of equalities says one thing!

## §7.13: Logs in Other Bases

$\log(y)$  is how many tens you multiply together to get  $y$ .

$\log_2(y)$  is how many twos you multiply together to get  $y$ .

So  $2^3 = 8$  means the same thing as  $\log_2(8) = 3$

Examples:

$$\log_2(16) = 4$$

$$\text{because } 2^4 = 16$$

$$\log_2(32) = 5$$

$$\text{because } 2^5 = 32$$

$$\log_2(1/8) = -3$$

$$\text{because } 2^{-3} = 1/8$$

The five laws of logs work for any base  $b$  exactly the same way except...

$$b^{\log(y)} = y$$

$$\log_b(b^a) = a$$

# Summary & Examples

## Important bases:

- $\log_2$  is used extensively in computer science
- $\ln = \log_e$  is used everywhere (the natural log) ( $e \approx 2.718$ )  
 $\log_e(y) = x$  means  $e^x = y$   
 $\log_e(y)$  is how many  $e$ 's you multiply to get  $y$ .  
 Read as: “log base  $e$  of  $y$  equals  $x$ .”

## Examples:

$$\log_3(81) = \text{(A) } 0 \quad \text{(B) } 1 \quad \text{(C) } 2 \quad \text{(D) } 3 \quad \text{(E) } 4 \quad \boxed{\text{E}}$$

$$\log_5(25) = \text{(A) } 0 \quad \text{(B) } 1 \quad \text{(C) } 2 \quad \text{(D) } 3 \quad \text{(E) } 4 \quad \boxed{\text{C}}$$

$$\text{Simplify } \ln \left( (e^{3x} \times e^y)^2 \right)$$

$$\text{(A) } 6x + y \quad \text{(B) } 2x + 2y \quad \text{(C) } 3x + 2y \quad \text{(D) } 6x + 2y \quad \text{(E) } 6xy$$

$$\text{Answer: } \boxed{\text{D}}$$

# Review Question #1

If the price of an airplane ticket is \$300, then the airline sells 2,000 tickets. For each dollar the airline increases the price, it sells 10 fewer tickets.

**1.** If the price is \$400, how many tickets does the airline sell?

- (A) 2000   (B) 1000   (C) 3000   (D) 1990   (E) 2400   **B**

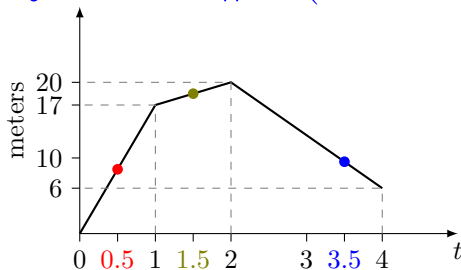
**2.** If the price is  $\$(300 + n)$ , how many tickets does the airline sell?

- (A)  $2000 - n$    (B)  $2000 + 10n$    (C)  $2000 - 10n$     $D = 2000/n$    **C**

**3.** If the price is  $\$x$ , how many tickets does the airline sell?

- (A)  $2000 + 10x$    (B)  $2000 - 10x$    (C)  $5000 - 10x$    (D)  $1000 + 10x$   
**C**

## Review Question #2 (HW13 #9)



$$\text{speed at } 0.5 = \frac{\text{dist. gone betw. } t = 0 \text{ and } t = 1}{1 \text{ sec}} = \frac{17 - 0 \text{ meters}}{1 \text{ sec}} = 17 \text{ m/s}$$

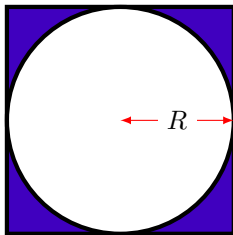
$$\text{speed at } 1.5 = \frac{\text{dist. gone betw. } t = 1 \text{ and } t = 2}{1 \text{ sec}} = \frac{20 - 17 \text{ meters}}{2 - 1 \text{ sec}} = 3 \text{ m/s}$$

$$\text{speed at } 3.5 = \frac{\text{dist. gone betw. } t = 2 \text{ and } t = 4}{2 \text{ sec}} = \frac{6 - 20 \text{ meters}}{4 - 2 \text{ sec}} = -7 \text{ m/s}$$

Or is that last speed +7 m/s?

## Review Question #3

A square contains a circle which touches all four sides of the square. Express the area of the part of the square outside the circle in terms of the radius of the circle.



(A) I have an answer

(B) I know what to do

(C) I am thinking

(D) I do not know where to start

Answer?

The side of the square is  $2R$ , so the square has area  $(2R)^2 = 4R^2$ .

The area of the circle is  $\pi R^2$ .

The shaded area is  $4R^2 - \pi R^2$  or  $(4 - \pi)R^2$ .

(A) got it

(B) close

(C) not so close



# Review Question #4

A bottle with DRINK ME written on it contains 50% pure water and 50% **magicerium**. Alice wishes to add some of this to 7 liters of pure water to obtain a **brew** which is 20% **magicerium** and the rest pure water. How many liters should she take from the bottle labelled DRINK ME?

- (A) 7      (B) 14      (C)  $14/3$       (D)  $7/3$       (E) 20      **C**

# Short Review Questions

1. What is the slope of the line  $2y - 3x = 5$ ?

(A) 3

(B)  $-3$

(C)  $2/3$

(D)  $3/2$

(E)  $-3/2$

D

2. What is the  $x$ -coordinate of the point where the lines

$$y + x = 5 \quad \text{and} \quad y = 3x - 2$$

intersect?

(A)  $-1/3$

(B)  $1/3$

(C)  $3/4$

(D)  $7/4$

D

3. Solve  $\frac{2^x}{3^{2x}} = 5$ .

(A)  $\log(5)/\log(2/3)$

(B)  $\log(5)/(\log(2) - \log(3))$

(C)  $\log(5)/(\log(2) + 2\log(3))$

(D)  $\log(5)/(\log(2) - 2\log(3))$

D