

Day 4. 6/28 Monday

**Exponents, radical, rational equations**

Finish all pages 1-19 by 6/29 12:00pm

# Exponents- In Class Notes

## 1. Exponents Rules

$x^0 =$	
$x^a \cdot x^b =$	
$x^a/x^b =$	
$(x^a)^b = (x^{ab})^n =$	
$(x + y)^n =$	
$x^{-n} =$	
$x^{1/n} =$	
$x^{m/n} =$	
$\sqrt{a} \cdot \sqrt{b} =$	

### PRACTICE 1

$$x^2 * x^b = x^{\frac{15}{2}}, b = ?$$

### PRACTICE 2

$$(2^3)^b = 256, b = ?$$

### PRACTICE 3

$$\frac{a^3 b^{-7} c^{-11}}{a^{-5} b^2 c^{-4}} =$$

**PRACTICE 4**

$$3^{-a} = 81, a = ?$$

**PRACTICE 5**

$$x^{\frac{3}{2}} = 8, x = ?$$

**PRACTICE 6**

$$2\sqrt{50} - 5\sqrt{32}$$

**PRACTICE 7**

$$\frac{9\sqrt{24}}{15\sqrt{27}} =$$

**PRACTICE 8**

$$7\sqrt{x} + 3 = 14, x =$$

# Exponents- Homework

- $9^3 \times 27^2 = 3^n, n =$
- $x^{-3} = \frac{1}{8}, x =$
- $4^{-a} = 64, a =$ 
  - 4
  - 4
  - 3
  - 3
  - 2
- $5\sqrt{8} + 7\sqrt{32} =$ 
  - $18\sqrt{2}$
  - $38\sqrt{2}$
  - $23\sqrt{4}$
  - $33\sqrt{3}$
  - $38\sqrt{3}$
- $4\sqrt{18} \times 11\sqrt{12} =$ 
  - $12\sqrt{6}$
  - $34\sqrt{6}$
  - $264\sqrt{6}$
  - $264\sqrt{3}$
  - $264\sqrt{2}$
- $y^{-5} = 1,024, y =$ 
  - 5
  - 4
  - 3
  - $\frac{1}{5}$
  - $\frac{1}{4}$
- $2^{-n} = \frac{1}{256}, n =$
- $\sqrt{x} = 4a^2bc^3, x =$ 
  - $16a^4b^2c^9$
  - $16a^4b^2c^6$
  - $16a^2bc^3$
  - $8a^4b^2c^6$
  - $2ab^{\frac{1}{2}}c^{\frac{3}{2}}$
- $8^{12} = 2^x, x =$ 
  - 4
  - 12
  - 24
  - 36
  - 42
- $c^{\frac{2}{5}} = 4, c =$
- $\frac{9^{4x}}{27^{3x}} =$ 
  - $9^x$
  - $\frac{1}{3^x}$
  - $\frac{1}{9^x}$
  - $3^x$
  - $\frac{1}{4^x}$
- Which of the following is equal to  $5^{8x}$ ?
  - $(5^{4x})^4$
  - $(5^{4x})^2$
  - $(5^{4x})(5^{4x})$
  - I
  - II
  - III
  - I and II
  - II and III
- $n^3 \geq n^2$  for which of the following?
  - $n = 1$
  - $n = 0$
  - $n = -1$
  - I
  - II
  - III
  - I and II
  - II and III

$$14. \frac{a^2b^{-6}c^{11}d^{-4}}{a^{-5}b^{-2}c^7d^9} =$$

A.  $\frac{a^3b^4}{c^4d^{13}}$

B.  $\frac{a^7b^8}{c^4d^{13}}$

C.  $\frac{a^7c^4}{b^4d^{13}}$

D.  $\frac{c^7d^4}{a^4b^{13}}$

E.  $\frac{a^3c^4}{b^8d^{13}}$

$$15. 27^{\frac{4}{x}} = 81, x =$$

A. 2

B. 3

C. 4

D. 5

E. 6

$$16. 3\sqrt{x} - 7 = 5, x =$$

$$17. 9\sqrt{x} - 7\sqrt{x} - 36 = -16, x =$$

A. 5

B. 10

C. 20

D. 50

E. 100

$$18. x = 2, y = x^2, (y^2 - x^3)\left(\frac{x^2}{3y}\right) =$$

A. 2

B. 3

C. 4

D. 5

E. 6

$$19. \sqrt{x} + c\sqrt{y} = d\sqrt{y}, \frac{x}{y} =$$

A.  $d - c$

B.  $\sqrt{d - c}$

C.  $c - d$

D.  $(d - c)^2$

E.  $\sqrt{c - d}$

## What is radical / rational equations?

**Radical equations** are equations in which variables appear under radical symbols ( $\sqrt{\quad}$ ).

- $\sqrt{2x - 1} = x$  is a radical equation.

**Rational equations** are equations in which variables can be found in the denominators of rational expressions.

- $\frac{1}{x + 1} = \frac{2}{x}$  is a rational equation.

Both radical and rational equations can have **extraneous solutions**, algebraic solutions that emerge as we solve the equations that do not satisfy the original equations. In other words, extraneous solutions *seem* like they're solutions, but they aren't. On the SAT, we sometimes need to identify and exclude extraneous solutions from the solution set by plugging solutions back into the original equation.

## What is the extraneous solution(s)?

$$\text{If } a = b, \text{ then } a^2 = b^2?$$

$$\text{If } a^2 = b^2, \text{ then } a = b?$$

# Solving Radical Equations – In class Notes

To solve a radical equation:

1. Isolate the radical expression to one side of the equation.
2. Square both sides the equation.
3. Rearrange and solve the resulting equation.

To check for extraneous solutions to a radical equation:

1. Solve the radical equation as outlined above.
2. Substitute the solutions into the original equation. A solution is extraneous if it does not satisfy the original equation.

Try it!

## PRACTICE 1

What is the solution to the equation  $\sqrt{3x + 4} = x$  ?

## PRACTICE 2

$$\sqrt{6x + 9} = x + 3$$

Which of the following values of  $x$  satisfies the equation above?

Choose 1 answer:

---

(A) 0

---

(B) 3

---

(C) 6

---

(D) 9

---

# Rational Equations - In Class Notes (Optional)

To solve a rational equation:

1. Rewrite the equation until the variable no longer appears in the denominators of rational expressions.
2. Rearrange and solve the resulting linear or quadratic equation.

To check for extraneous solutions to a rational equation:

1. Solve the rational equation as outlined above.
2. Substitute the solution(s) into the original equation. A solution is extraneous if it does not satisfy the original equation.

Try it!

## PRACTICE 3

$$\frac{3x}{x+2} = 2$$

## PRACTICE 4

What value(s) of  $x$  satisfies the equation  $\frac{2}{x-1} = \frac{x+1}{x-1}$ ?



### PRACTICE 5

If  $\frac{1}{x+1} = \frac{3}{5x-1}$ , what is the value  $x$ ?

Choose 1 answer:

---

(A)  $\frac{1}{3}$

---

(B)  $\frac{1}{2}$

---

(C) 1

---

(D) 2

---

### PRACTICE 6

Which of the following values of  $x$  satisfies the equation  $\frac{x^2 - 4x}{x - 4} = 1$ ?

Choose 1 answer:

---

(A) 1 only

---

(B) 4 only

---

(C) 1 and 4

---

(D) No such value of  $x$  exists.

---

## PRACTICE 7

$$\frac{2k}{3k+12} + \frac{k+7}{k^2+4k}$$

Which expression is equivalent to the above sum?

---

(A)  $\frac{2k^2 + 3k + 21}{3k^2 + 12k}$

---

(B)  $\frac{2k^2 + 14k}{3k^3 + 24k^2 + 48k}$

---

(C)  $\frac{3k + 7}{k^2 + 7k + 12}$

---

(D)  $\frac{3k + 7}{k + 4}$

## PRACTICE 8

$$\frac{49m^4n - 21m^6n^2}{7m^2n^4}$$

Which expression is equivalent to the above for all  $m > 1$  and  $n > 1$ ?

---

(A)  $7m^2n^4 - 3m^4n^2$

---

(B)  $7m^2n^3 - 3m^4n^2$

---

(C)  $\frac{7m^2 - 3m^3}{n^2}$

---

(D)  $\frac{7m^2 - 3m^4n}{n^3}$

### PRACTICE 9

$$\frac{4k^2 - 12k + 9}{2k^2 + 19k - 33} \cdot \frac{k^2 + 8k - 33}{k^2 - 3k}$$

Which expression is equivalent to the above product for  $k \geq 33$ ?

---

(A)  $\frac{2k - 3}{k}$

---

(B)  $\frac{8(4k^2 + 13)}{(2k + 19)}$

---

(C)  $\frac{(2k^2 + 9)(2k^2 - 33)}{4k^4 - 57k^2 - 33}$

---

(D)  $\frac{2k^4 + 20k^3 - 73k^2 + 53k - 297}{k(k^3 + 13k^2 - 30k + 11)}$

### PRACTICE 10

$$\frac{5m^2 + 7m}{2m - 9} - \frac{2m}{2m - 9}$$

Which expression is equivalent to the above difference?

---

(A)  $\frac{3m^2 + 7m}{2m - 9}$

---

(B)  $\frac{5m^2 + 5m}{2m - 9}$

---

(C)  $\frac{5m + 9m}{2m - 9}$

---

(D)  $\frac{5m^2 + 7m - 1}{2m - 9}$

## PRACTICE 11

$$\frac{5x}{6y} \cdot \frac{3}{10y}$$

Which expression is equivalent to the above product for all  $y > 0$ ?

(A)  $\frac{x}{2}$

(B)  $\frac{25x}{9}$

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

(D)  $\frac{x}{4y^2}$

## PRACTICE 12

Which of the following is equivalent to  $\left(\frac{1}{\sqrt{x}}\right)^n$ ?

A)  $x^{\frac{n}{2}}$

B)  $x^{-\frac{n}{2}}$

C)  $x^{n+\frac{1}{2}}$

D)  $x^{n-\frac{1}{2}}$

## PRACTICE 13

$$x - 12 = \sqrt{x + 44}$$

What are all possible solutions to the given equation?

A) 5

B) 20

C) -5 and 20

D) 5 and 20

### PRACTICE 14

$$\frac{3}{t+1} = \frac{2}{t+3} + \frac{1}{4}$$

If  $t$  is a solution to the given equation and  $t > 0$ , what is the value of  $t$ ?

### PRACTICE 15

$$3x + y = -3$$

$$(x + 1)^2 - 4(x + 1) - 6 = y$$

If  $(x, y)$  is a solution of the system of equations above and  $y > 0$ , what is the value of  $y$ ?

### PRACTICE 16

If an object of mass  $m$  is moving at speed  $v$ , the object's kinetic energy (KE) is given by the equation  $\text{KE} = \frac{1}{2}mv^2$ . If the mass of the object is halved and its speed is doubled, how does the kinetic energy change?

- A) The kinetic energy is halved.
- B) The kinetic energy is unchanged.
- C) The kinetic energy is doubled.
- D) The kinetic energy is quadrupled (multiplied by a factor of 4).

### PRACTICE 17

$$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$$

This is known as Graham's law. Which of the following correctly expresses  $M_2$  in terms of  $M_1$ ,  $r_1$ , and  $r_2$ ?

- A)  $M_2 = M_1 \left( \frac{r_1^2}{r_2^2} \right)$
- B)  $M_2 = M_1 \left( \frac{r_2^2}{r_1^2} \right)$
- C)  $M_2 = \sqrt{M_1} \left( \frac{r_1}{r_2} \right)$
- D)  $M_2 = \sqrt{M_1} \left( \frac{r_2}{r_1} \right)$


# Exponent, radical, rational equations - Homework

due 6/29 12:00pm

Submit the answers & work to [virginiasemeducation@gmail.com](mailto:virginiasemeducation@gmail.com) or (703)965-8530


1. Please go to the following link (& Log in to Khan Academy):

<https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:rational-exponents-radicals> Finish the Skills summary and submit it.

**Skill Summary** 

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Exponent properties review




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Quiz 1: 5 questions

Practice what you've learned, and level up on the above skills

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Radicals




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Quiz 2: 5 questions

Practice what you've learned, and level up on the above skills

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Simplifying square roots



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Unit test

Test your knowledge of all skills in this unit



2. Please go to the following link, submit the 100% grades:

<https://www.khanacademy.org/mission/sat/practice/math>

### Passport to advanced mathematics

These build on the skills from Heart of algebra by applying them to other function types.



Solving quadratic equations

Practice



Interpreting nonlinear expressions

Practice



Quadratic and exponential word problems

Practice



Manipulating quadratic and exponential expressions

Practice



Radicals and rational exponents

Practice



Radical and rational equations

Practice



Operations with rational expressions

Practice

# SAT Practice - Homework

due 6/29 12:00pm

Submit the answers & work to [virginiasemeducation@gmail.com](mailto:virginiasemeducation@gmail.com) or (703)965-8530

16

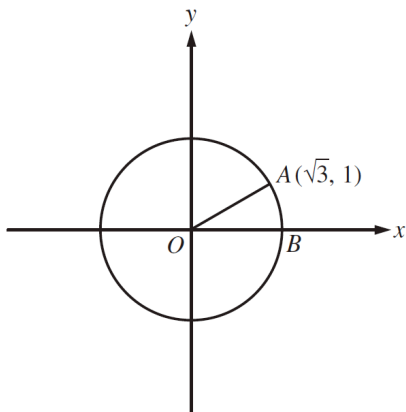
The sales manager of a company awarded a total of \$3000 in bonuses to the most productive salespeople. The bonuses were awarded in amounts of \$250 or \$750. If at least one \$250 bonus and at least one \$750 bonus were awarded, what is one possible number of \$250 bonuses awarded?

17

$$2x(3x + 5) + 3(3x + 5) = ax^2 + bx + c$$

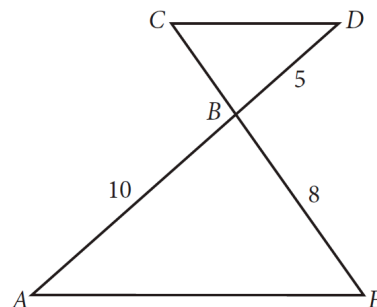
In the equation above,  $a$ ,  $b$ , and  $c$  are constants. If the equation is true for all values of  $x$ , what is the value of  $b$ ?

19



In the  $xy$ -plane above,  $O$  is the center of the circle, and the measure of  $\angle AOB$  is  $\frac{\pi}{a}$  radians. What is the value of  $a$ ?

18



In the figure above,  $\overline{AE} \parallel \overline{CD}$  and segment  $AD$  intersects segment  $CE$  at  $B$ . What is the length of segment  $CE$ ?

20

$$\begin{aligned} ax + by &= 12 \\ 2x + 8y &= 60 \end{aligned}$$

In the system of equations above,  $a$  and  $b$  are constants. If the system has infinitely many solutions, what is the value of  $\frac{a}{b}$ ?



## Homework - Advanced Real Test Questions

15. If the average (arithmetic mean) of the measures of two noncongruent angles of an isosceles triangle is  $70^\circ$ , which of the following is the measure of one of the angles of the triangle?

(A)  $50^\circ$   
 (B)  $60^\circ$   
 (C)  $80^\circ$   
 (D)  $90^\circ$   
 (E)  $100^\circ$

17. If  $s$  is the sum of 3 consecutive odd integers and  $n$  is one of the 3 odd integers, which of the following could be true?

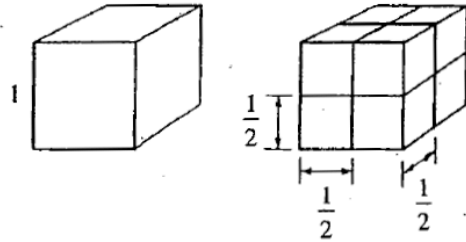
(A)  $s = 3n$   
 (B)  $s = 3n + 3$   
 (C)  $s = 3n - 3$   
 (D)  $s = 6n$   
 (E)  $s = 6n + 1$

ANNA'S DAILY SERVINGS OF  
FRUITS AND VEGETABLES

Day	Fruits	Vegetables
Monday	5	0
Tuesday	1	4
Wednesday	2	2
Thursday	3	2
Friday	3	3

16. A nutrition expert recommends that a person eat a minimum of 5 servings of fruits or vegetables a day; these 5 servings are to include at least 2 servings of fruit and at least 2 servings of vegetables. On how many days listed in the table above did Anna satisfy all the recommendations of the nutrition expert?

(A) One  
 (B) Two  
 (C) Three  
 (D) Four  
 (E) Five

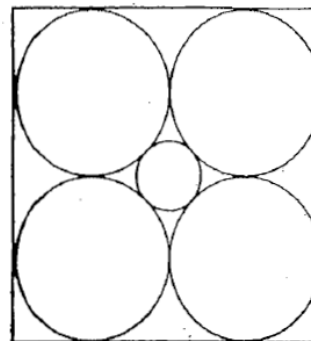


18. If a 1-inch cube of cheese were cut in half in all three directions as shown above, then the total surface area of the separated smaller cubes would be how much greater than the surface area of the original 1-inch cube?

(A) 2 square inches  
 (B) 4 square inches  
 (C) 6 square inches  
 (D) 8 square inches  
 (E) 12 square inches

19. If  $w = x + y + z$ , what is the average (arithmetic mean) of  $w$ ,  $x$ ,  $y$ , and  $z$  in terms of  $w$ ?

- (A)  $\frac{w}{2}$
- (B)  $\frac{w}{3}$
- (C)  $\frac{w}{4}$
- (D)  $\frac{w}{6}$
- (E)  $\frac{w}{8}$



20. In the figure above, each of the four large circles is tangent to two of the other large circles, the small circle, and two sides of the square. If the radius of each of the large circles is 1, what is the radius of the small circle?

- (A)  $\frac{1}{4}$
- (B)  $\frac{1}{2}$
- (C)  $\frac{\sqrt{2} - 1}{2}$  (approximately 0.207)
- (D)  $\sqrt{2} - 1$  (approximately 0.414)
- (E)  $\frac{\sqrt{2}}{2}$  (approximately 0.707)

5. If  $\frac{x}{y} = 2$  and  $\frac{z}{x} = 4$ , what is the value

of  $\frac{x + y + z}{x}$ ?

- (A)  $4\frac{1}{2}$
- (B) 5
- (C)  $5\frac{1}{2}$
- (D) 6
- (E) 7

---

1, -2, 3, -4, 5, -6, ...

6. The first six terms of a sequence are shown above. The odd-numbered terms are increasing consecutive positive odd integers starting with 1. The even-numbered terms are decreasing consecutive negative even integers starting with -2. What is the sum of the 50th and 51st terms of the sequence?

- (A) -101
- (B) -1
- (C) -0
- (D) 1
- (E) 101

7. In the  $xy$ -plane, a line contains the points (4, 2), (-2, -1), and (k, 5). What is the value of  $k$ ?

- (A) 6
- (B) 7
- (C) 8
- (D) 9
- (E) 10

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8. If  $x^{\frac{2}{3}} = y$ , what does  $x^4$  equal in terms of  $y$ ?

- (A)  $y^2$
- (B)  $y^{\frac{8}{3}}$
- (C)  $y^3$
- (D)  $y^5$
- (E)  $y^6$

Day 5. 7/1 Wednesday

**Percent (growth), exponential function**

Finish pages 20-32 by 7/2 12:00pm

## Percent word problems – In class Notes

1. “percent” means \_\_\_\_\_
2. “%” means \_\_\_\_\_
3. “of” means \_\_\_\_\_
4. “what” means \_\_\_\_\_
5. “is” means \_\_\_\_\_
6. “20% greater than x” means \_\_\_\_\_
7. “3% less than y” means \_\_\_\_\_
8. “100% greater than a” means \_\_\_\_\_
9. “b% less than c” means \_\_\_\_\_
10. If a worker earns 20% commission, this means \_\_\_\_\_

**Express each verbal phrase into proportion & algebraic equation.**

**PRACTICE 1) What is 15% of 80?**

**PRACTICE 2) What percent of 160 is 100?**

**PRACTICE 3) 15 is 20% of what number?**

**PRACTICE 4) What is 0.2% of  $5x$ ?**

**PRACTICE 5) 60% of 30% of  $x$  is?**

**PRACTICE 6) 120 percent greater than 50 is?**

## Percent – Homework

1

28% of what number is 7?

2

3.6 is 240% of what number?

3

$\frac{1}{2}\%$  of 180 is what number?

4

$3\frac{1}{3}\%$  of what number is 2.5?

5

26.4 is 0.55% of what number?

6

What percent of 12 is 8?

- A) 60%
- B)  $66\frac{2}{3}\%$
- C) 75%
- D)  $130\frac{1}{3}\%$

7

54 is 120% of  $k$ .

Which of the following proportions could be used to solve the above expression?

- A)  $\frac{100}{120} = \frac{54}{k}$
- B)  $\frac{54}{100} = \frac{120}{k}$
- C)  $\frac{100}{54} = \frac{120}{k}$
- D)  $\frac{120}{100} = \frac{54}{k}$

8

If Kevin's monthly salary of \$4,500 is 72 percent of Paul's monthly salary, what is Paul's monthly salary?

- A) \$3,240
- B) \$5,150
- C) \$5,870
- D) \$6,250

## ***Percent Change – In class Notes***

- **Percent Increase**
  
- **Percent Decrease**

**PRACTICE 1.** A \$300 notebook is on sale for \$240. What is the percent discount?

**PRACTICE 2.** The population increased from 24 million to 34 million. What's the percent increase of the population?

## ***Percent Shortcuts– In Class Notes***

- **Increased**  $\text{Final} = \text{initial} * (1+r)$
- **Decreased**  $\text{Final} = \text{initial} * (1-r)$   
( $1 \pm r$  is the **growth factor**, while  $r$  is the **growth rate**)

**PRACTICE 3.** A concert ticket was on sale for 30% off, and you paid \$85 after 5% tax of the sale price. How much was the original ticket price?

**PRACTICE 4.** A pair of NIKE shoes is on sale for 20% off and there's additional 50% off for the clearance sale. Is the final price equivalent to 70% of the original price? If not, how much is the total discount percentage?

**PRACTICE 5.** A desk is on sale for \$260 after the 15% discount. How much is the original price of the desk without any discount?

# Percent – Homework

1

Which of the following is equivalent to 0.03 % of 4?

- A) 0.12
- B) 0.012
- C) 0.0012
- D) 0.00012

2

$$\frac{1}{400} =$$

- A) 0.25%
- B) 0.025%
- C) 0.0025%
- D) 0.00025%

3

The quantities  $x$  and  $y$  are positive. If  $x$  is decreased by 20 percent and  $y$  is increased by 20 percent, then the product of  $x$  and  $y$  is

- A) unchanged
- B) decreased by 4%
- C) increased by 5%
- D) decreased by 6%

4

By what percent is  $4.5 \times 10^5$  greater than  $9 \times 10^4$ ?

- A) 200%
- B) 400%
- C) 500%
- D) 600%

5

The temperature increased from  $60^\circ\text{F}$  to  $72^\circ\text{F}$ . What is the percent increase in temperature?

- A) 15%
- B)  $\frac{50}{3}\%$
- C) 20%
- D)  $\frac{70}{3}\%$

6

This year's enrollment in Mesa School District is 6,000, which is 20 percent higher than last year's. What was last year's enrollment in Mesa School District?

7

If 125% of  $x$  is 80 and  $x$  is  $n\%$  of 400, what is the value of  $n$ ?



## ***Percent word problems – In Class Notes***

### ○ **Discount / Tax**

The sale price of a laptop is \$580 after 30% discount and 8% tax. What was the original price of the laptop before discount and tax?

### ○ **Mixture Problem**

How many L of 60% solution must be added to 80L of a 40% acid solution to make the 55% final solution?

A furniture store buys its furniture from a wholesaler. For a particular style of table, the store usually sells a table for 75% more than the cost of the table from the wholesaler. During a sale, the store sells the table for 15% more than the cost from the wholesaler. If the sale price of the table is \$299, what is the usual price for the table?

- A) \$359
- B) \$455
- C) \$479
- D) \$524

## Percent – Homework

1

There are  $n$  candies in a jar. If one candy is removed, what percent of the candies are left in terms of  $n$ ?

- A)  $100(1-n)\%$
- B)  $100\left(\frac{1}{n}-1\right)\%$
- C)  $100\left(n-\frac{1}{n}\right)\%$
- D)  $100\left(\frac{n-1}{n}\right)\%$

2

The price of a cellphone was discounted by 25% and then discounted an additional 20%, to become \$348. What was the original price of the cellphone before it was discounted twice?

- A) \$580.00
- B) \$620.00
- C) \$650.00
- D) \$680.00

3

A chemist mixes a 40% acid solution and a 30% acid solution. How many liters of the 40% solution must be added to produce 50 liters of a solution that is 36% acid?

- A) 24
- B) 26
- C) 30
- D) 32

4

Victor invests part of his \$5,000 in a savings account that pays 4.5% annual simple interest. He invests the rest in bonds that pay 8% annual simple interest. Let  $s$  be the amount invested in savings and  $r$  be the amount invested in bonds. Victor's total income in one year from these investments is \$305.50. Which of the following systems of equations represents this relationship?

- A) 
$$\begin{cases} 0.045s + 0.08r = 5,000 \\ s + r = 305.50 \end{cases}$$
- B) 
$$\begin{cases} 0.08s + 0.045r = 5,000 \\ s + r = 305.50 \end{cases}$$
- C) 
$$\begin{cases} s + r = 5,000 \\ 0.045s + 0.08r = 305.50 \end{cases}$$
- D) 
$$\begin{cases} s + r = 5,000 \\ 0.08s + 0.045r = 305.50 \end{cases}$$

5

A sporting goods store added 50% profit cost and 8% tax to the price of a backpack, which then became \$129.60. What was the price of the backpack before adding profit and tax?

6

There are 800 students in a school and 45% of the students are male. If 30% of the male students and 25% of the female students play varsity sports, how many students play varsity sports?

**1**

A chemist mixes  $x$  mL of a 34% acid solution with a 10% acid solution. If the resulting solution is 40 mL with 25% acidity, what is the value of  $x$ ?

- A) 18.5
- B) 20
- C) 22.5
- D) 25

**2**

The price of a package of 4 pens is \$8.00. The same pens are sold at \$2.50 each. If Alex bought three packages of pens rather than buying 12 pens individually, the amount he saved on 12 pens is what percent of the amount he paid?

- A) 12%
- B) 20%
- C) 25%
- D) 30%

**3**

There are 600 bottles of sports drinks in a store. 25% of the bottles are orange flavored drinks. On Monday 30% of the orange flavored drinks in the store were sold and on Tuesday 20% of the remaining orange flavored drinks were sold. How many bottles of orange flavored drinks were sold in the two days?

- A) 52
- B) 58
- C) 66
- D) 75

**4**

A tablet with a list price of  $x$  dollars is discounted by 15% and then discounted an additional 12%. What is the final sale price of the tablet, in terms of  $x$ ?

- A)  $0.73x$
- B)  $0.748x$
- C)  $0.75x$
- D)  $0.765x$

**5**

There is a total of  $n$  pairs of shoes in a store, all of which are either black or brown. If there are  $m$  pairs of brown shoes in the store, then in terms of  $m$  and  $n$ , what percent of the shoes in the store are black?

- A)  $\frac{m}{n}\%$
- B)  $\frac{n-m}{n}\%$
- C)  $(1 - \frac{100m}{n})\%$
- D)  $100(1 - \frac{m}{n})\%$

**6**

The numbers  $a$ ,  $b$ , and  $c$  are positive and  $a$  equals  $3.2bc$ . If  $b$  is increased by 150% and  $c$  is decreased by 60%, then  $a$  is

- A) increased by 90%
- B) increased by 10%
- C) unchanged
- D) decreased by 10%

**7**

There are 10 history books in a bookcase. When the number of books increases by  $x$  percent, the new number of history books is 24. What is the value of  $x$ ?

- A) 58
- B) 70
- C) 120
- D) 140

**8**

Number  $n$  is 25 less than 120 percent of itself. What is the value of  $n$ ?

- A) 125
- B) 120
- C) 105
- D) 90

**9**

Of the 500 cars displayed in a certain car dealer, 7 percent are blue and 4 percent are red. The number of blue cars in the car dealer are what percent greater than the number of red cars?

- A) 30%
- B) 50%
- C) 75%
- D) 125%

**10**

If 300% of 0.18 is equivalent to 20% of  $b$ , then  $b$  is equivalent to what number?

**11**

Five people contributed \$9,000 each toward the purchase of a sailboat. If they ended up paying \$38,500 plus 8% sales tax for the boat, how much money should be refunded to each person?

**12**

A store used to sell an MP3 for \$72, which is 50% more than the wholesale cost. At a special holiday sale, the price of the MP3 was 20% less than the wholesale cost. What was the special sale price of the MP3?

# Simple Interest vs. Compound Interest

## Simple Interest - In Class Notes

Interest: The amount of money that you pay to borrow money or the amount of money that you earn on a deposit

Annual Interest Rate: The percent of interest that you pay for money borrowed, or earn for money deposited

Simple interest formula:  $I = Prt$  where  $I$  is the interest earned,  $P$  is the principal or the amount of money that you start out with,  $r$  is the annual interest rate as a decimal, and  $t$  is the time in years.

Balance: The sum of the principal  $P$  and the interest  $Prt$ .

### Simple Interest PRACTICE 1

Josh borrowed \$250 from his mother to buy an electric scooter. Josh will pay her back in 1 year with 3% simple annual interest. How much interest will Josh pay?

**Solution**

$I = Prt$  Use the formula for simple interest.

$I = (250)(0.03)(1)$  Substitute \$250 for  $P$ , 0.03 for  $r$ , and 1 for  $t$ .

$I = \$750$  Multiply.

**ANSWER** Josh will pay his mom \$7.50 in interest.

### Simple Interest PRACTICE 2

You deposit \$300 in a savings account that pays 4% simple annual interest. Find your account balance after 9 months.

**Solution**

Write 9 months as  $\frac{9}{12}$  year, or 0.75 year.

$A = P + Prt$  Write the balance formula.

$= 300 + (300)(0.04)(0.75)$  Substitute \$300 for  $P$ , 0.04 for  $r$ , and 0.75 for  $t$ .

$= 300 + 9$  Multiply.

$= 309$  Add.

**ANSWER** Your account balance after 9 months is \$309.

## Simple Interest / Investment PRACTICE 3

Bob invested a total of \$7500 in stocks and bonds. The stocks pay 6.5% interest a year and the bonds pay 8% interest a year. His interest income is \$528 this year. How much money was invested in stocks?

## Compound Interest – In Class Notes

**Compound interest:** Interest that is earned on both the principal and any interest that has been earned previously.

**Compound interest formula:**  $A = P(1 + r)^t$  where  $A$  represents the amount of money in the account at the end of the time period,  $P$  is the principal,  $r$  is the annual interest rate, and  $t$  is the time in years.

**Balance:** The sum of the principal and the interest

## Compound Interest PRACTICE 1

Simon deposits \$400 in an account that pays 3% interest compounded annually. What is the balance of Simon's account at the end of 2 years?

**Solution**

**Step 1** Find the balance at the end of the first year.

$$I = Prt \quad \text{Use the simple interest formula.}$$

$$= (400)(0.03)(1)$$

$$= 12$$

$$\text{Balance} = P + Prt \quad \text{Use the balance formula.}$$

$$= 400 + 12$$

$$= 412$$

The balance at the end of the first year is \$412.

**Step 2** Find the balance at the end of the second year.

$$I = Prt \quad \text{Use the simple interest formula.}$$

$$= (412)(0.03)(1)$$

$$= 12.36$$

$$\text{Balance} = P + Prt \quad \text{Use the balance formula.}$$

$$= 412 + 12.36$$

$$= 424.36$$

**ANSWER** Simon has \$424.36 in his account after 2 years.

Try using this question using the compound interest formula.

## Compound Interest PRACTICE 2

Jackie deposits \$325 in an account that pays 4.1% interest compounded annually. How much money will Jackie have in her account after 3 years?

**Solution**

$$A = P(1 + r)^t \quad \text{Use the compound interest formula.}$$

$$A = 325(1 + 0.041)^3 \quad \text{Substitute 325 for } P, 0.041 \text{ for } r, \text{ and 3 for } t.$$

$$A = 325(1.041)^3 \quad \text{Add.}$$

$$A = 366.64 \quad \text{Simplify.}$$

**ANSWER** Jackie will have \$366.64 in her account after 3 years.

### Learn More:

<https://www.khanacademy.org/test-prep/sat/sat-math-practice/new-sat-problem-solving-data-analysis/v/sat-math-q2-easier>

# Compound Interest Practice – Homework

**Directions:** Use the formula  $A = P\left(1 + \frac{r}{n}\right)^{nt}$  where  $A$  represents the total amount,  $P$  represents the principal,  $r$  represents the interest rate as a decimal,  $n$  represents the number of times per year interest is compounded, and  $t$  represents the time in years to answer the questions below.

- 1) A coin had a value of \$1.17 in 1995. Its value has been increasing at 9% per year. What is the value after 5 years?
- 2) Gina deposited \$1500 in an account that pays 4% interest compounded quarterly. What will the balance be in 2 years?
- 3) The Garcias have \$12,000 in a savings account. The bank pays 3.5% interest on savings accounts, compounded monthly. Find the total balance after three years.
- 4) Determine the amount of **interest** earned on a \$2500 investment if it is invested at 5.25% annual interest compounded monthly for four years.
- 5) Determine the amount of **interest** earned on a \$100,000 investment if it is invested at 5.2% annual interest compounded quarterly for 12 years.



Day 4. 7/3 Friday

## **Homework**

Finish pages 33-44 by 7/5 6:00pm

## SAT Real Test Practice

1

A musician has a new song available for downloading or streaming. The musician earns \$0.09 each time the song is downloaded and \$0.002 each time the song is streamed. Which of the following expressions represents the amount, in dollars, that the musician earns if the song is downloaded  $d$  times and streamed  $s$  times?

- A)  $0.002d + 0.09s$
- B)  $0.002d - 0.09s$
- C)  $0.09d + 0.002s$
- D)  $0.09d - 0.002s$

2

A quality control manager at a factory selects 7 lightbulbs at random for inspection out of every 400 lightbulbs produced. At this rate, how many lightbulbs will be inspected if the factory produces 20,000 lightbulbs?

- A) 300
- B) 350
- C) 400
- D) 450

3

$$\ell = 24 + 3.5m$$

One end of a spring is attached to a ceiling. When an object of mass  $m$  kilograms is attached to the other end of the spring, the spring stretches to a length of  $\ell$  centimeters as shown in the equation above. What is  $m$  when  $\ell$  is 73?

- A) 14
- B) 27.7
- C) 73
- D) 279.5

**Questions 4 and 5 refer to the following information.**

The amount of money a performer earns is directly proportional to the number of people attending the performance. The performer earns \$120 at a performance where 8 people attend.

**4**

How much money will the performer earn when 20 people attend a performance?

- A) \$960
- B) \$480
- C) \$300
- D) \$240

**5**

The performer uses 43% of the money earned to pay the costs involved in putting on each performance. The rest of the money earned is the performer's profit. What is the profit the performer makes at a performance where 8 people attend?

- A) \$51.60
- B) \$57.00
- C) \$68.40
- D) \$77.00

**6**

When 4 times the number  $x$  is added to 12, the result is 8. What number results when 2 times  $x$  is added to 7?

- A)  $-1$
- B)  $5$
- C)  $8$
- D)  $9$

**7**

$$y = x^2 - 6x + 8$$

The equation above represents a parabola in the  $xy$ -plane. Which of the following equivalent forms of the equation displays the  $x$ -intercepts of the parabola as constants or coefficients?

- A)  $y - 8 = x^2 - 6x$
- B)  $y + 1 = (x - 3)^2$
- C)  $y = x(x - 6) + 8$
- D)  $y = (x - 2)(x - 4)$

8

In a video game, each player starts the game with  $k$  points and loses 2 points each time a task is not completed. If a player who gains no additional points and fails to complete 100 tasks has a score of 200 points, what is the value of  $k$  ?

- A) 0
- B) 150
- C) 250
- D) 400

9

A worker uses a forklift to move boxes that weigh either 40 pounds or 65 pounds each. Let  $x$  be the number of 40-pound boxes and  $y$  be the number of 65-pound boxes. The forklift can carry up to either 45 boxes or a weight of 2,400 pounds. Which of the following systems of inequalities represents this relationship?

- A)  $\begin{cases} 40x + 65y \leq 2,400 \\ x + y \leq 45 \end{cases}$
- B)  $\begin{cases} \frac{x}{40} + \frac{y}{65} \leq 2,400 \\ x + y \leq 45 \end{cases}$
- C)  $\begin{cases} 40x + 65y \leq 45 \\ x + y \leq 2,400 \end{cases}$
- D)  $\begin{cases} x + y \leq 2,400 \\ 40x + 65y \leq 2,400 \end{cases}$

10

A function  $f$  satisfies  $f(2) = 3$  and  $f(3) = 5$ . A function  $g$  satisfies  $g(3) = 2$  and  $g(5) = 6$ . What is the value of  $f(g(3))$  ?

- A) 2
- B) 3
- C) 5
- D) 6

11

Number of hours Tony plans to read the novel per day	3
Number of parts in the novel	8
Number of chapters in the novel	239
Number of words Tony reads per minute	250
Number of pages in the novel	1,078
Number of words in the novel	349,168

Tony is planning to read a novel. The table above shows information about the novel, Tony's reading speed, and the amount of time he plans to spend reading the novel each day. If Tony reads at the rates given in the table, which of the following is closest to the number of days it would take Tony to read the entire novel?

- A) 6
- B) 8
- C) 23
- D) 324



12

On January 1, 2000, there were 175,000 tons of trash in a landfill that had a capacity of 325,000 tons. Each year since then, the amount of trash in the landfill increased by 7,500 tons. If  $y$  represents the time, in years, after January 1, 2000, which of the following inequalities describes the set of years where the landfill is at or above capacity?

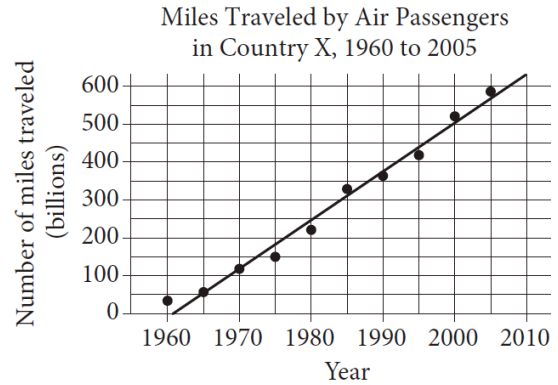
- A)  $325,000 - 7,500 \leq y$
- B)  $325,000 \leq 7,500y$
- C)  $150,000 \geq 7,500y$
- D)  $175,000 + 7,500y \geq 325,000$

13

A researcher conducted a survey to determine whether people in a certain large town prefer watching sports on television to attending the sporting event. The researcher asked 117 people who visited a local restaurant on a Saturday, and 7 people refused to respond. Which of the following factors makes it least likely that a reliable conclusion can be drawn about the sports-watching preferences of all people in the town?

- A) Sample size
- B) Population size
- C) The number of people who refused to respond
- D) Where the survey was given

14



According to the line of best fit in the scatterplot above, which of the following best approximates the year in which the number of miles traveled by air passengers in Country X was estimated to be 550 billion?

- A) 1997
- B) 2000
- C) 2003
- D) 2008

15

The distance traveled by Earth in one orbit around the Sun is about 580,000,000 miles. Earth makes one complete orbit around the Sun in one year. Of the following, which is closest to the average speed of Earth, in miles per hour, as it orbits the Sun?

- A) 66,000
- B) 93,000
- C) 210,000
- D) 420,000

16

Results on the Bar Exam of Law School Graduates

	Passed bar exam	Did not pass bar exam
Took review course	18	82
Did not take review course	7	93

The table above summarizes the results of 200 law school graduates who took the bar exam. If one of the surveyed graduates who passed the bar exam is chosen at random for an interview, what is the probability that the person chosen did not take the review course?

- A)  $\frac{18}{25}$
- B)  $\frac{7}{25}$
- C)  $\frac{25}{200}$
- D)  $\frac{7}{200}$

17

The atomic weight of an unknown element, in atomic mass units (amu), is approximately 20% less than that of calcium. The atomic weight of calcium is 40 amu. Which of the following best approximates the atomic weight, in amu, of the unknown element?

- A) 8
- B) 20
- C) 32
- D) 48

18

A survey was taken of the value of homes in a county, and it was found that the mean home value was \$165,000 and the median home value was \$125,000. Which of the following situations could explain the difference between the mean and median home values in the county?

- A) The homes have values that are close to each other.
- B) There are a few homes that are valued much less than the rest.
- C) There are a few homes that are valued much more than the rest.
- D) Many of the homes have values between \$125,000 and \$165,000.



Questions 19 and 20 refer to the following information.

A sociologist chose 300 students at random from each of two schools and asked each student how many siblings he or she has. The results are shown in the table below.

Students' Sibling Survey

Number of siblings	Lincoln School	Washington School
0	120	140
1	80	110
2	60	30
3	30	10
4	10	10

There are a total of 2,400 students at Lincoln School and 3,300 students at Washington School.

19

What is the median number of siblings for all the students surveyed?

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

20

Based on the survey data, which of the following most accurately compares the expected total number of students with 4 siblings at the two schools?

- A) The total number of students with 4 siblings is expected to be equal at the two schools.
- B) The total number of students with 4 siblings at Lincoln School is expected to be 30 more than at Washington School.
- C) The total number of students with 4 siblings at Washington School is expected to be 30 more than at Lincoln School.
- D) The total number of students with 4 siblings at Washington School is expected to be 900 more than at Lincoln School.

21

A project manager estimates that a project will take  $x$  hours to complete, where  $x > 100$ . The goal is for the estimate to be within 10 hours of the time it will actually take to complete the project. If the manager meets the goal and it takes  $y$  hours to complete the project, which of the following inequalities represents the relationship between the estimated time and the actual completion time?

- A)  $x + y < 10$
- B)  $y > x + 10$
- C)  $y < x - 10$
- D)  $-10 < y - x < 10$

---

Questions 22 and 23 refer to the following information.

$$I = \frac{P}{4\pi r^2}$$

At a large distance  $r$  from a radio antenna, the intensity of the radio signal  $I$  is related to the power of the signal  $P$  by the formula above.

22

Which of the following expresses the square of the distance from the radio antenna in terms of the intensity of the radio signal and the power of the signal?

- A)  $r^2 = \frac{IP}{4\pi}$
- B)  $r^2 = \frac{P}{4\pi I}$
- C)  $r^2 = \frac{4\pi I}{P}$
- D)  $r^2 = \frac{I}{4\pi P}$

23

For the same signal emitted by a radio antenna, Observer A measures its intensity to be 16 times the intensity measured by Observer B. The distance of Observer A from the radio antenna is what fraction of the distance of Observer B from the radio antenna?

- A)  $\frac{1}{4}$
  - B)  $\frac{1}{16}$
  - C)  $\frac{1}{64}$
  - D)  $\frac{1}{256}$
- 

24

$$x^2 + y^2 + 4x - 2y = -1$$

The equation of a circle in the  $xy$ -plane is shown above. What is the radius of the circle?

- A) 2
- B) 3
- C) 4
- D) 9

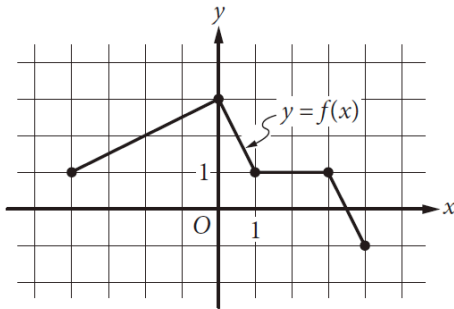


25

The graph of the linear function  $f$  has intercepts at  $(a, 0)$  and  $(0, b)$  in the  $xy$ -plane. If  $a + b = 0$  and  $a \neq b$ , which of the following is true about the slope of the graph of  $f$ ?

- A) It is positive.
- B) It is negative.
- C) It equals zero.
- D) It is undefined.

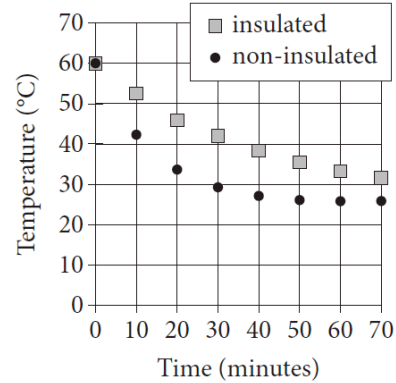
26



The complete graph of the function  $f$  is shown in the  $xy$ -plane above. Which of the following are equal to 1?

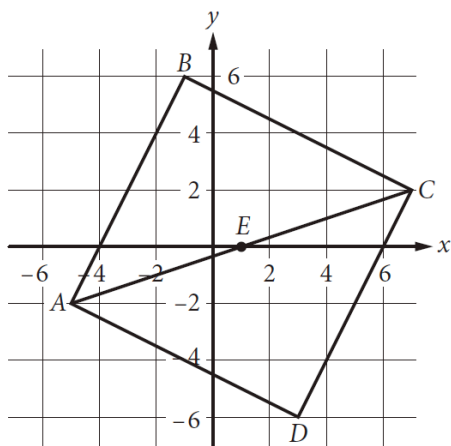
- I.  $f(-4)$
  - II.  $f\left(\frac{3}{2}\right)$
  - III.  $f(3)$
- A) III only
  - B) I and III only
  - C) II and III only
  - D) I, II, and III

27



Two samples of water of equal mass are heated to 60 degrees Celsius ( $^{\circ}\text{C}$ ). One sample is poured into an insulated container, and the other sample is poured into a non-insulated container. The samples are then left for 70 minutes to cool in a room having a temperature of  $25^{\circ}\text{C}$ . The graph above shows the temperature of each sample at 10-minute intervals. Which of the following statements correctly compares the average rates at which the temperatures of the two samples change?

- A) In every 10-minute interval, the magnitude of the rate of change of temperature of the insulated sample is greater than that of the non-insulated sample.
- B) In every 10-minute interval, the magnitude of the rate of change of temperature of the non-insulated sample is greater than that of the insulated sample.
- C) In the intervals from 0 to 10 minutes and from 10 to 20 minutes, the rates of change of temperature of the insulated sample are of greater magnitude, whereas in the intervals from 40 to 50 minutes and from 50 to 60 minutes, the rates of change of temperature of the non-insulated sample are of greater magnitude.
- D) In the intervals from 0 to 10 minutes and from 10 to 20 minutes, the rates of change of temperature of the non-insulated sample are of greater magnitude, whereas in the intervals from 40 to 50 minutes and from 50 to 60 minutes, the rates of change of temperature of the insulated sample are of greater magnitude.



In the  $xy$ -plane above,  $ABCD$  is a square and point  $E$  is the center of the square. The coordinates of points  $C$  and  $E$  are  $(7, 2)$  and  $(1, 0)$ , respectively. Which of the following is an equation of the line that passes through points  $B$  and  $D$ ?

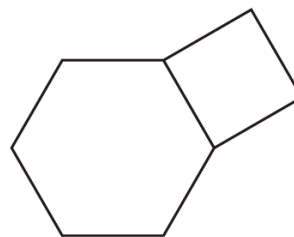
- A)  $y = -3x - 1$
- B)  $y = -3(x - 1)$
- C)  $y = -\frac{1}{3}x + 4$
- D)  $y = -\frac{1}{3}x - 1$

$$y = 3$$

$$y = ax^2 + b$$

In the system of equations above,  $a$  and  $b$  are constants. For which of the following values of  $a$  and  $b$  does the system of equations have exactly two real solutions?

- A)  $a = -2, b = 2$
- B)  $a = -2, b = 4$
- C)  $a = 2, b = 4$
- D)  $a = 4, b = 3$



The figure above shows a regular hexagon with sides of length  $a$  and a square with sides of length  $a$ . If the area of the hexagon is  $384\sqrt{3}$  square inches, what is the area, in square inches, of the square?

- A) 256
- B) 192
- C)  $64\sqrt{3}$
- D)  $16\sqrt{3}$

31

A coastal geologist estimates that a certain country's beaches are eroding at a rate of 1.5 feet per year. According to the geologist's estimate, how long will it take, in years, for the country's beaches to erode by 21 feet?

32

If  $h$  hours and 30 minutes is equal to 450 minutes, what is the value of  $h$  ?

35

$$a = 18t + 15$$

Jane made an initial deposit to a savings account. Each week thereafter she deposited a fixed amount to the account. The equation above models the amount  $a$ , in dollars, that Jane has deposited after  $t$  weekly deposits. According to the model, how many dollars was Jane's initial deposit? (Disregard the \$ sign when gridding your answer.)

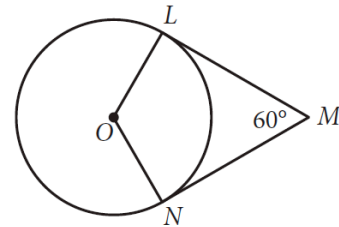
33

In the  $xy$ -plane, the point  $(3, 6)$  lies on the graph of the function  $f(x) = 3x^2 - bx + 12$ . What is the value of  $b$  ?

34

In one semester, Doug and Laura spent a combined 250 hours in the tutoring lab. If Doug spent 40 more hours in the lab than Laura did, how many hours did Laura spend in the lab?

36



In the figure above, point  $O$  is the center of the circle, line segments  $LM$  and  $MN$  are tangent to the circle at points  $L$  and  $N$ , respectively, and the segments intersect at point  $M$  as shown. If the circumference of the circle is 96, what is the length of minor arc  $\widehat{LN}$  ?

---

**Questions 37 and 38 refer to the following information.**

A botanist is cultivating a rare species of plant in a controlled environment and currently has 3000 of these plants. The population of this species that the botanist expects to grow next year,  $N_{\text{next year}}$ , can be estimated from the number of plants this year,  $N_{\text{this year}}$ , by the equation below.

$$N_{\text{next year}} = N_{\text{this year}} + 0.2\left(N_{\text{this year}}\right)\left(1 - \frac{N_{\text{this year}}}{K}\right)$$

The constant  $K$  in this formula is the number of plants the environment is able to support.

**37**

According to the formula, what will be the number of plants two years from now if  $K = 4000$ ? (Round your answer to the nearest whole number.)

**38**

The botanist would like to increase the number of plants that the environment can support so that the population of the species will increase more rapidly. If the botanist's goal is that the number of plants will increase from 3000 this year to 3360 next year, how many plants must the modified environment support?

---

### Math Test Calculator Answers

1 C	11 B	21 D	31 14
2 B	12 D	22 B	32 7
3 A	13 D	23 A	33 11
4 C	14 C	24 A	34 105
5 C	15 A	25 A	35 15
6 B	16 B	26 D	36 32
7 D	17 C	27 D	37 3284
8 D	18 C	28 B	38 7500
9 A	19 B	29 B	
10 B	20 C	30 A	

Now, check the answers.