

No Calculator

**EASY!**  
**GET SUPER FAMILIAR!**

**4 P.O.E.**

$$9a^4 + 12a^2b^2 + 4b^4$$

NOTICE  
THEN  
ELIMINATE  
ANSWERS

Which of the following is equivalent to the expression shown above?

- A)  $(3a^2 + 2b^2)^2$   $2^2 = 4$
- B)  $(3a + 2b)^4$   $2^4 \neq 4$
- C)  $(9a^2 + 4b^2)^2$   $4^2 \neq 4$
- D)  $(9a + 4b)^4$   $4^4 \neq 4$

**5**

$$\sqrt{2k^2 + 17} - x = 0$$

If  $k > 0$  and  $x = 7$  in the equation above, what is the value of  $k$ ?

- A) 2
- B) 3
- C) 4
- D) 5

$$\begin{aligned} \sqrt{2k^2 + 17} - x &= 0 && \nearrow 2k^2 = 32 \\ \sqrt{2k^2 + 17} - 7 &= 0 && k^2 = 16 \\ \sqrt{2k^2 + 17} &= 7 && k = 4 \\ 2k^2 + 17 &= 49 && \\ 2k^2 &= 32 && \end{aligned}$$

**7 EXPONENT / EXPRESSIONS**

If  $\frac{x^a}{x^b} = x^{16}$ ,  $x > 1$ , and  $a + b = 2$ , what is the value

of  $a - b$ ?

- A) 8
- B) 14
- C) 16
- D) 18

$$\begin{aligned} \frac{x^a}{x^b} &= x^{16} \Rightarrow a^2 - b^2 = 16 \\ (a+b)(a-b) &= 16 \\ 2(a-b) &= 16 \\ a-b &= 8 \end{aligned}$$

**10 PLUG IN NUMBERS**

Which of the following equations has a graph in the  $xy$ -plane for which  $y$  is always greater than or equal to  $-1$ ?

GET FAMILIAR!

- A)  $y = |x| - 2$
- B)  $y = x^2 - 2$
- C)  $y = (x - 2)^2$
- D)  $y = x^3 - 2$

C. SHOWS YOU A POSITIVE PARABOLA WITH A +4  $\checkmark$ -INTERCEPT

**12 SOLVE FOR F**

$$R = \frac{F}{N + F}$$

A website uses the formula above to calculate a seller's rating,  $R$ , based on the number of favorable reviews,  $F$ , and unfavorable reviews,  $N$ . Which of the following expresses the number of favorable reviews in terms of the other variables?

- A)  $F = \frac{RN}{R - 1}$
- B)  $F = \frac{RN}{1 - R}$
- C)  $F = \frac{N}{1 - R}$
- D)  $F = \frac{N}{R - 1}$

$$\begin{aligned} R &= \frac{F}{N + F} \\ R(N + F) &= F \\ RN + RF &= F \\ RN &= F - RF \\ RN &= F(1 - R) \\ \frac{RN}{1 - R} &= F \end{aligned}$$

**13**

What is the sum of all values of  $m$  that satisfy

$$2m^2 - 16m + 8 = 0?$$

- A)  $-8$
- B)  $-4\sqrt{3}$
- C)  $4\sqrt{3}$
- D)  $8$

THE HOOK!  
WHEN FACTORED:

$$2(m^2 - 8m + 4) = 0$$

$$\text{SO } m^2 - 8m + 4 = 0$$

YOU'RE TEMPTED TO USE QUADRATIC FORM - DON'T!

TAKE  $-8$  AND CHANGE SIGN  $+8$

QUICK NOTE:  
 $x^2 + 2x + 1 = 0$   
 $(x + 1)^2 = 0$   
SO,  $x + 1 = 0$   
 $x = -1$   
AND  $x + 1 = 0$   
 $x = -1$   
SUM OF X'S  
 $= -2$   
THE OPPOSITE OF  $x^2$

**14 GET FAMILIAR!**  
Also Used as Analysis in Science

A radioactive substance decays at an annual rate of 13 percent. If the initial amount of the substance is 325 grams, which of the following functions  $f$  models the remaining amount of the substance, in grams,  $t$  years later?

- A)  $f(t) = 325(0.87)^t$
- B)  $f(t) = 325(0.13)^t$
- C)  $f(t) = 0.87(325)^t$
- D)  $f(t) = 0.13(325)^t$

DECAYS = DECREASE  
SO  $100\% - 13\% = 87\%$   
 $= .87$

**15 SIMPLE LONG DIVISION**

The expression  $\frac{5x - 2}{x + 3}$  is equivalent to which of the following?

- A)  $\frac{5 - 2}{3}$
- B)  $5 - \frac{2}{3}$
- C)  $5 - \frac{2}{x + 3}$
- D)  $5 - \frac{17}{x + 3}$

$$\begin{array}{r} 5R - 17 \\ x + 3 \overline{) 5x - 2} \\ \underline{-5x + 15} \\ -17 \end{array}$$

**17 DISTRIBUTE CAREFULLY**

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

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  $b$ ?

$$\begin{aligned} 2x(3x + 5) + 3(3x + 5) &= ax^2 + bx + c \\ 6x^2 + 10x + 9x + 15 &= \\ 6x^2 + 19x + 15 &= ax^2 + bx + c \\ a &= 6 \\ b &= 19 \\ c &= 15 \end{aligned}$$

With Calculator

**PARABOLA BASICS**

GET FAMILIAR WITH WORDING OF QUESTION

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

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)  $y = (x - 2)(x - 4)$

"FACTOR"  
 $x^2 - 6x + 8$   
 $(x - 4)(x - 2) = 0$   
 $x = 4 \quad x = 2$

**SIMPLE FUNCTIONS**

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

$f(x) = f(g(3))$   
 $= f(2)$   
 $= 3$

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.

SOLVE FOR  $r^2$

22. Also Used as Analysis in Science

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

$I = \frac{P}{4\pi r^2}$  SOLVE FOR  $r^2$   
 $I 4\pi r^2 = P$  MULTIPLY BOTH SIDES BY DENOM.  
 $r^2 = \frac{P}{I 4\pi}$  THEN DIVIDE BY  $I 4\pi$

**RATIO BUT SOLVE FOR "R"**

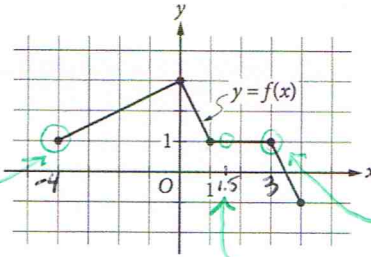
23. Also Used as Analysis in Science

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)  $\frac{1}{256}$

$\frac{(16)P}{4\pi r^2} = \frac{(1)P}{4\pi R^2}$   
 $\frac{P}{4\pi r^2} = \frac{P}{64\pi R^2}$   
 NOTICE  
 $4\pi r^2 = 64\pi R^2$   
 $4r^2 = 64R^2$   
 $\sqrt{4r^2} = \sqrt{64R^2}$   
 $2r = 8R$   
 $\frac{2r}{8r} = \frac{1}{4}$

**BASIC FUNCTIONS**



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

- I.  $f(-4) = 1$
- II.  $f\left(\frac{3}{2}\right) = 1$
- III.  $f(3) = 1$

- A) III only
- B) I and III only
- C) II and III only
- D) I, II, and III

NOTICE III IN ALL ANSWERS, SO YOU DON'T HAVE TO PROVE IT; IT MUST WORK!

REMEMBER ALWAYS  $f(x) = y$   
 KEEP IT SIMPLE LOOK AND SEE:  
 IF  $x = 0 \quad y = 3$   
 $x = -2 \quad y = +2$   
 $x = +2 \quad y = 1$   
 $x = +3 \quad y = 1$   
 $x = +4 \quad y = -1$   
 ETC

**PLUG IN ANSWERS**

$y = 3$   
 $y = ax^2 + b$  } ALSO MEANS  $ax^2 + b = 3$

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)  $a = -2, b = 2 = -2x^2 + 2 = 3 = \sqrt{x^2} = \sqrt{-1.5}$  NOPE
- B)  $a = -2, b = 4 = -2x^2 + 4 = 3 = \sqrt{x^2} = \sqrt{1.5}$  YUP
- C)  $a = 2, b = 4 = 2x^2 + 4 = 3 = \sqrt{x^2} = \sqrt{-1.5}$  NOPE
- D)  $a = 4, b = 3 = 4x^2 + 3 = 3 = \sqrt{x^2} = \sqrt{0}$  NOPE

**PLUG IN NUMBERS**

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  $b$ ?

$f(x) = 3x^2 - bx + 12 = 6$   
 $f(3) = 3(3)^2 - b(3) + 12 = 6$   
 $= 3(9) - 3b + 12 = 6$   
 $= 27 - 3b + 12 = 6$   
 $= -3b = -33$   
 $b = 11$