

**Quadratic Equations**

2. Which of the following is the **ordinate** of the vertex of the function  $f(x) = 2x^2 - 8x + 3$ ?

$a=2$   
 $b=-8$   
 $c=3$

- A) 2
- B) 0.5
- C) -5**
- D) -8

$x_v = \frac{-b}{2a}$   
 $= \frac{+8}{2(2)}$   
 $= \frac{8}{4}$   
 $= 2$

$y = 2(2)^2 - 8(2) + 3$   
 $= -5$

$x^2 - 2x - 1 = 0$

The equation above has solutions  $x = n + \sqrt{k}$  and  $x = n - \sqrt{k}$ , where  $n$  and  $k$  are positive integers. What is the value of  $n+k$ ?

$a=1$   
 $b=-2$   
 $c=-1$

$n=1$   
 $k=2$

$n+k$   
 $1+2$   
**3**

$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$   
 $\frac{+2 \pm \sqrt{(-2)^2 - 4(1)(-1)}}{2(1)}$   
 $\frac{2 \pm \sqrt{4+4}}{2} = \frac{2 \pm \sqrt{8}}{2} = \frac{2 \pm 2\sqrt{2}}{2}$   
 $1 \pm \sqrt{2}$

$3x^2 + \frac{1x}{3} - \frac{2}{3} = 0$   
 $1 \pm \sqrt{2}$

The solutions to the quadratic equation above are  $a$  and  $b$ . What is the value of  $a+b$ ?

- A)  $-\frac{5}{3}$
- B)  $-\frac{1}{3}$**
- C)  $\frac{1}{3}$
- D)  $\frac{5}{3}$

$x^2 + \frac{1}{3}x - \frac{2}{3} = 0$

$x^2 - 14x + 40 = 2x + 1$

What is the **sum** of the solutions to the given equation?

- A) -16
- B) -14
- C) 14
- D) 16**

$x^2 - 14x - 2x + 40 - 1 = 0$   
 $x^2 - 16x + 39 = 0$   
 Prod. = 39

What is the **sum** of all values of  $m$  that satisfy  $\frac{2m^2}{2} - \frac{16m}{2} + \frac{8}{2} = 0$ ?

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

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

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

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

$(x+a)(x-b) \rightarrow$  roots,  $x$ -int, Sol  
 $(x-h)^2 + k \rightarrow$  vertex, Max, Min

$x^2 - \text{sum } x + \text{Prod} = 0$   
 $x^2 - 5x + 6 = 0$   
 Sum = 5  
 Prod = 6

$ax^2 + bx + c$   
 $x_v = \frac{-b}{2a}$   
 $y_v = \dots$   
 x-vertex abscissa axis of sym  
 y-vertex ordinate



**Complex**

11. If  $i = \sqrt{-1}$  which of the following is equivalent to

$$\frac{-3}{2-i} \times \frac{2+i}{2+i} = \frac{-3(2+i)}{4 - (i^2)(-1)}$$

A)  $\frac{3}{5}(2+i)$   $\frac{-3(2+i)}{4+1}$

**B)  $\frac{3}{5}(2+i)$**   $\frac{-3(\quad)}{5}$

~~C)  $-2-i$~~

~~D)  $2+i$~~

$i^2 = -1$   
 $i^3 = -i$   
 $i^4 = 1$   
 $i^0 = 1$

Which of the following complex numbers is equivalent to  $\frac{3-5i}{8+2i}$ ? (Note:  $i = \sqrt{-1}$ )

~~A)  $\frac{3}{8} - \frac{5i}{2}$~~

~~B)  $\frac{3}{8} + \frac{5i}{2}$~~

**C)  $\frac{7}{34} - \frac{23i}{34}$**

~~D)  $\frac{7}{34} + \frac{23i}{34}$~~

$\frac{3-5i}{8+2i} \times \frac{8-2i}{8-2i} = \frac{24-6i-40i+10i^2}{64-4i^2}$   
 $\frac{24-46i-10}{64+4} = \frac{14-46i}{68} = \frac{7-23i}{34}$

$i^2 = -1$   
 $i^3 = -i$   
 $i^4 = 1$   
 $i^0 = 1$

If the expression above is written in the form  $a+bi$ , where  $a$  and  $b$  are constants, what is the value of  $b$ ?

A)  $-\frac{4}{13}$

B)  $\frac{4}{13}$

**C)  $-\frac{7}{13}$**

D)  $\frac{7}{13}$

$$\frac{2i+1}{3i-2} \times \frac{3i+2}{3i+2}$$

$$\frac{6i^2+4i+3i+2}{9i^2+6i-6i-4} = \frac{-6+7i+2}{-9-4} = \frac{-4+7i}{-13}$$

$$\frac{-4+7i}{-13} = \frac{4}{13} - \frac{7}{13}i$$

$i^2 = -1$   
 $i^3 = -i$   
 $i^4 = 1$   
 $i^0 = 1$

In the complex number system, which of the following is equal to

$$3i(1+i) - (1-i)^2$$

(Note:  $i = \sqrt{-1}$ )

A.  $-3+i$

**B.  $-3+5i$**

C.  $3+i$

D.  $3+5i$

$3i(1+i) - (1-i)^2 = 3i+3i^2 - (1-2i+i^2) = 3i-3 - (1-2i-1) = 3i-3 - (-2i) = 3i-3+2i = -3+5i$

$i^2 = -1$   
 $i^3 = -i$   
 $i^4 = 1$   
 $i^0 = 1$

$(a+b)^2 = a^2 + 2ab + b^2$   
 $(a-b)^2 = a^2 - 2ab + b^2$   
 $a^2 - b^2 = (a-b)(a+b)$



**Circles**

In the  $xy$ -plane, the graph of

$\frac{2x^2}{2} - \frac{6x}{2} + \frac{2y^2}{2} + \frac{2y}{2} = \frac{45}{2}$  is a circle. What is the radius of the circle?

- A) 5
- B) 6.5
- C)  $\sqrt{40}$
- D)  $\sqrt{50}$

$$x^2 - 3x + y^2 + y = 22.5$$

$$r = \sqrt{\left(\frac{-3}{-2}\right)^2 + \left(\frac{1}{-2}\right)^2 + 22.5}$$

$$= 5$$

$x^2 - 10x + y^2 + 6y = 2$

The graph in the  $xy$ -plane of the equation above is a circle. What are the coordinates of the center of the circle?

- A)  $(-5, -3)$
- B)  $(-5, 3)$
- C)  $(5, -3)$
- D)  $(5, 3)$

$$\frac{-10}{-2}, \frac{6}{-2}$$

$$(5, -3)$$

The graph of  $x^2 - 4x + y^2 + 6y - 24 = 0$  in the  $xy$ -plane is a circle. What is the radius of the circle?

- A)  $2\sqrt{6}$
- B)  $\sqrt{11}$
- C)  $\sqrt{37}$
- D)  $\sqrt{76}$

$$x^2 - 4x + y^2 + 6y = 24$$

$$r = \sqrt{\left(\frac{-4}{-2}\right)^2 + \left(\frac{6}{-2}\right)^2 + 24}$$

$$= \sqrt{37}$$

**Circles**

$$(x-h)^2 + (y-k)^2 = r^2$$

Center  $(h, k)$   
radius =  $\sqrt{r^2}$

$$x^2 + ax + y^2 + by = c$$

$$C\left(\frac{-a}{-2}, \frac{-b}{-2}\right)$$

$$r = \sqrt{\left(\frac{-a}{-2}\right)^2 + \left(\frac{-b}{-2}\right)^2 + c}$$

Which of the following equations describes a circle with radius 10 that passes through the origin when graphed in the  $xy$ -plane?

- ~~A)  $(x-5)^2 + (y+5)^2 = 10$~~
- ~~B)  $(x-5)^2 + (y+5)^2 = 100$~~
- ~~C)  $(x-10)^2 + (y-10)^2 = 100$~~
- D)  $(x-5\sqrt{2})^2 + (y+5\sqrt{2})^2 = 100$

$$(0,0) = r^2$$

$$= (10)^2$$

$$= 100$$

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

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

$$\sqrt{\left(\frac{4}{-2}\right)^2 + \left(\frac{-2}{-2}\right)^2 + (-1)}$$

$$= 2$$

$x^2 + 20x + y^2 + 16y = -20$

The equation above defines a circle in the  $xy$ -plane. What are the coordinates of the center of the circle?

- A)  $(-20, -16)$
- B)  $(-10, -8)$
- C)  $(10, 8)$
- D)  $(20, 16)$

$$\frac{20}{-2}$$

$$-10$$



**Powers**

Which of the following is an equivalent form of

$\sqrt[3]{f^{6a}k^2}$ , where  $f > 0$  and  $k > 0$ ?

- A)  $f^{\frac{1}{3a}}k^{-1}$        $f^{\frac{6a}{3}}k^{\frac{2}{3}}$
- B)  $f^{\frac{1}{2a}}k^{\frac{3}{2}}$
- C)  $f^{3a}k^{-1}$        $f^{2a}k^{\frac{2}{3}}$

D)  $f^{2a}k^{\frac{2}{3}}$

If  $3^x \cdot \sqrt[4]{3} = 9^{2x}$ , then  $x =$

- A) 4
- B)  $\frac{1}{12}$        $3^x \cdot 3^{\frac{1}{4}} = 3^{2(2x)}$
- C)  $\frac{4}{3}$        $x + \frac{1}{4} = 4x$
- D)  $\frac{-7}{4}$

$x + \frac{1}{4} = 4x$   
 $\frac{1}{4} = 3x$        $\frac{1 \times 1}{4 \times 3} = \frac{1}{12}$

If  $(x^{2a-3})^2 = x^{14}$ , then what is the value of  $a$ ?

$2(2a-3) = 14$   
 $4a - 6 = 14$   
 $4a = 20$   
 $a = \frac{20}{4}$        **$a = 5$**

$x^2 \cdot x^5 = x^7$   
 $\frac{x^5}{x^2} = x^{5-2}$   
 $(x^2)^5 = x^{2 \times 5}$   
 $\sqrt{a} x^b = x^{\frac{a}{2}b}$   
 $\sqrt{x^5} = x^{\frac{5}{2}}$   
 $\sqrt{x} = x^{\frac{1}{2}}$

Which of the following is equal to  $a^{\frac{2}{3}}$ , for all values of  $a$ ?

- A)  $\sqrt{a^{\frac{1}{3}}}$
- B)  $\sqrt{a^3}$
- C)  $\sqrt[3]{a^{\frac{1}{2}}}$
- D)  $\sqrt[3]{a^2}$        $\sqrt[3]{a^2}$

If  $27^{81} = 3^x$ , what is the value of  $x$ ?

- A) 27
- B) 84
- C) 100
- D) 243       $3^{(81)} = 3^x$   
 $3^{(81)} = x$



**System of equations**

+  
-

$$\begin{aligned} 7x + 3y &= 8 \\ 6x - 3y &= 5 \end{aligned}$$

For the solution  $(x, y)$  to the system of equations above, what is the value of  $x - y$ ?

- A)  $-\frac{4}{3}$
- B)  $\frac{2}{3}$**
- C)  $\frac{4}{3}$
- D)  $\frac{22}{3}$

$$\begin{aligned} 13x &= 13 \\ x &= 1 \end{aligned}$$

$$\begin{aligned} 2(1) + 3y &= 8 \\ 2 + 3y &= 8 \\ 3y &= 6 \\ y &= 2 \end{aligned}$$

$$\begin{aligned} x - y &= 1 - 2 \\ &= -1 \end{aligned}$$

$$\begin{aligned} 7x(4x + y) &= 7x(7) \\ 28x + 7y &= 49 \\ 2x - 7y &= 1 \\ \hline 30x &= 50 \\ x &= \frac{50}{30} \\ x &= \frac{5}{3} \end{aligned}$$

If  $(x, y)$  is the solution to the given system of equations, what is the value of  $x$ ?

Cancel y

$$x = \frac{5}{3}$$

$$\begin{aligned} x + 2y &= 10 \\ 2x - y &= 5 \end{aligned}$$

The solution to the given system of equations is  $(x, y)$ . What is the value of  $3x + y$ ?

- A) 5
- B) 7
- C) 13
- D) 15**

$$3x + y = 15$$

$$\begin{aligned} ax + by &= c \\ dx + ey &= f \end{aligned}$$

- 0  $\frac{a}{a} = \frac{b}{b}$
- 1  $\frac{a}{a} + \frac{b}{b}$
- ∞  $\frac{a}{a} = \frac{b}{b} = \frac{c}{c}$

$$\begin{aligned} 5x - y &= 9 \\ -60x + 12y &= -108 \end{aligned}$$

How many solutions does the given system of equations have?

- A) Zero
- B) Exactly one
- C) Exactly two
- D) Infinitely many**

$$\frac{5}{-60} = \frac{-1}{12} = \frac{9}{-108}$$

$$\begin{aligned} 2x + 3y &= 5 \\ 4x + cy &= 8 \end{aligned}$$

In the system of equations above,  $c$  is a constant. For what value of  $c$  will there be no solution  $(x, y)$  to the system of equations?

- A) 3
- B) 4
- C) 5
- D) 6**

$$\frac{2}{4} = \frac{3}{c}$$

$$c = \frac{3 \times 4}{2}$$

A farmer sold 108 pounds of produce that consisted of  $z$  pounds of zucchini and  $c$  pounds of cucumbers. The farmer sold the zucchini for \$1.69 per pound and the cucumbers for \$0.99 per pound and collected a total of \$150.32. Which of the following systems of equations can be used to find the number of pounds of zucchini that were sold?

- ~~A)  $\begin{aligned} z + c &= 150.32 \\ 1.69z + 0.99c &= 108 \end{aligned}$~~
- B)  $\begin{aligned} z + c &= 108 \\ 1.69z + 0.99c &= 150.32 \end{aligned}$**
- C)  $\begin{aligned} z + c &= 108 \\ 0.99z + 1.69c &= 150.32 \end{aligned}$
- ~~D)  $\begin{aligned} z + c &= 150.32 \\ 0.99z + 1.69c &= 108 \end{aligned}$~~

$$z + c = 108$$

$$1.69z$$