**Use a graph of each function to estimate the indicated function values.**

|  |  |  |  |
| --- | --- | --- | --- |
| **1.** | $$f\left(x\right)=-x+3$$$$f\left(-1\right)=? f\left(0\right)=? f\left(3\right)=?$$ | **2.** | $$f\left(x\right)=x^{3}-3x^{2}+2$$$$f\left(-1\right)=? f\left(0\right)=? f\left(2\right)=?$$ |
|  | $$Graphically$$ |  | $$Graphically$$ |
|  | $$Algebraically$$ |  | $$Algebraically$$ |

**Use the graph of each function to approximate its y –intercept. Then find the y –intercept algebraically.**

|  |  |  |  |
| --- | --- | --- | --- |
| **3.** | $$f\left(x\right)=x^{2}+2x+3$$ | **4.** | $f\left(x\right)=\sqrt{x+2}+2$ |
|  |  |  |  |
|  | $$Graphically$$$$Algebraically$$ |  | $$Graphically$$$$Algebraically$$ |
| **5.** | $$f\left(x\right)=2x-3$$ | **6.** | $$f\left(x\right)=\left|x+2\right|$$ |
|  |  |  |  |
|  | $$Graphically$$$$Algebraically$$ |  | $$Graphically$$$$Algebraically$$ |

**Use the graph of each function to approximate its zeros. Then find the zeros of each function algebraically.**

|  |  |  |
| --- | --- | --- |
| **7.** | $$f\left(x\right)=-x^{2}-2x+3$$ |  |
|  |  | $$Graphically$$$$Algebraically$$ |
| **8.** | $$f\left(x\right)=2x^{3}-x^{2}-3x$$ |  |
|  |  | $$Graphically$$$$Algebraically$$ |
| **9.** | $$f\left(x\right)=x^{3}-6x^{2}-12x+8$$ |  |
|  |  | $$Graphically$$$$Algebraically$$ |

**Use the graph of each equation to test for symmetry with respect to the x -axis, y -axis, and the origin. Support the answer numerically. Then confirm algebraically.**

|  |  |  |
| --- | --- | --- |
| **10.** | $$y=\sqrt{x^{2}+2}$$ |  |
|  |  | **Graphically****Support Numerically**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| $$x$$ |  |  |  |  |  |
| $$y$$ |  |  |  |  |  |
| $$(x,y)$$ |  |  |  |  |  |

**Algebraically** |
| **11.** | $$y=\sqrt[3]{x}$$ |  |
|  |  | **Graphically****Support Numerically**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| $$x$$ |  |  |  |  |  |
| $$y$$ |  |  |  |  |  |
| $$(x,y)$$ |  |  |  |  |  |

**Algebraically** |

|  |  |  |
| --- | --- | --- |
| **12.** | $$2x^{2}+3y^{2}=16$$ |  |
|  |  | **Graphically** |
|  | **Symmetric with respect to** $ x$ -**axis** |  |
|  | **Algebraically** | **Support Numerically**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| $$x$$ |  |  |  |  |
| $$y$$ |  |  |  |  |
| $$(x,y)$$ |  |  |  |  |

 |
|  | **Symmetric with respect to** $ y$ -**axis** |  |
|  | **Algebraically** | **Support Numerically**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| $$x$$ |  |  |  |  |
| $$y$$ |  |  |  |  |
| $$(x,y)$$ |  |  |  |  |

 |
|  | **Symmetric with respect to** **origin** |  |
|  | **Algebraically** | **Support Numerically**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| $$x$$ |  |  |  |  |
| $$y$$ |  |  |  |  |
| $$(x,y)$$ |  |  |  |  |

 |

**Determine whether the following are even, odd, or neither.**

|  |  |  |
| --- | --- | --- |
| **13.** | $$f\left(x\right)=x^{3}+2x$$ |  |
| **14.** | $g\left(t\right)=2t^{4}+t^{2}$ |  |
| **15.** | $$h\left(y\right)=y^{4}-5y^{2}-3y$$ |  |

**SOLVE REAL WORLD PROBLEM**

|  |  |
| --- | --- |
| **16.** | The temperature$T$in degrees Fahrenheit$ t$hours after 6 AM is given by$T\left(t\right)=-\frac{1}{2}t^{2}-8t+3, $$for 0<t<10.$Find $T\left(0\right)$**,** $T\left(2\right)$and$T\left(6\right) $graphically and algebraically. |
|  | **Graphically** | **Algebraically** |

**ANSWERS**

**Use a graph of each function to estimate the indicated function values.**

|  |  |  |  |
| --- | --- | --- | --- |
| **1.** | $$f\left(x\right)=-x+3$$$$f\left(-1\right)=? f\left(0\right)=? f\left(3\right)=?$$ | **2.** | $$f\left(x\right)=x^{3}-3x^{2}+2$$$$f\left(-1\right)=? f\left(0\right)=? f\left(2\right)=?$$ |
|  | $$Graphically$$$$f\left(-1\right)=4 f\left(0\right)=3 f\left(3\right)=0$$ |  | $$Graphically$$$$f\left(-1\right)=-2 f\left(0\right)=2 f\left(2\right)=-2$$ |
|  | $$Algebraically$$$$f\left(-1\right)=-\left(-1\right)+3=1+3=4$$$$f\left(0\right)=-0+3=3$$$$f\left(3\right)=-3+3=0$$ |  | $$Algebraically$$$$f\left(-1\right)=\left(-1\right)^{3}-3\left(-1\right)^{2}+2=-1-3+2=-2$$$$f\left(0\right)=0^{3}-3\*0^{2}+2=2$$$$f\left(2\right)=2^{3}-3\*2^{2}+2=8-12+2=-2$$ |

**Use the graph of each function to approximate its y –intercept. Then find the y –intercept algebraically.**

|  |  |  |  |
| --- | --- | --- | --- |
| **3.** | $$f\left(x\right)=x^{2}+2x+3$$ | **4.** | $f\left(x\right)=\sqrt{x+2}+2$ |
|  |  |  |  |
|  | $$Graphically$$$$f\left(x\right)=x^{2}+2x+3 y –intercept=3 $$$Algebraically y$ -intercept occurs where $x=0$.$$f\left(0\right)=0^{2}+2\*0+3$$$f\left(0\right)= 3$$ y –intercept=3$ |  | $$Graphically$$$f\left(x\right)=\sqrt{x+2}+2$$ y –intercept≈3.2 $$Algebraically y$ -intercept occurs where $x=0$.$f\left(0\right)=\sqrt{0+2}+2=\sqrt{2}+2$$f\left(0\right)≈ 3.41$$ y –intercept≈ 3.41$ |
| **5.** | $$f\left(x\right)=2x-3$$ | **6.** | $$f\left(x\right)=\left|x+2\right|$$ |
|  |  |  |  |
|  | $$Graphically$$$$f\left(x\right)=2x-3 y –intercept=-3 $$$Algebraically y$ -intercept occurs where $x=0$.$$f\left(0\right)=2\*0-3 $$$f\left(0\right)= -3$$ y –intercept=-3$ |  | $$Graphically$$$$f\left(x\right)=\left|x+2\right| y –intercept=2 $$$Algebraically y$ -intercept occurs where $x=0$.$$f\left(0\right)=\left|0+2\right|$$$f\left(0\right)= 2$$ y –intercept=2$ |

**Use the graph of each function to approximate its zeros. Then find the zeros of each function algebraically.**

|  |  |  |
| --- | --- | --- |
| **7.** | $$f\left(x\right)=-x^{2}-2x+3$$ |  |
|  |  | $$Graphically$$$$x -intercepts -3 and 1 $$$$ $$$$Algebraically $$$$f\left(x\right)=0$$$$-x^{2}-2x+3=0$$$$(x+3)\left(x-1\right)=0$$$$ x=-3 and x=1$$$$The zeros of f are -3 and 1$$ |
| **8.** | $$f\left(x\right)=2x^{3}-x^{2}-3x$$ |  |
|  |  | $$Graphically$$$$x -intercepts -1 ,0 and 1.5 $$$$ $$$$Algebraically $$$$f\left(x\right)=0$$$$2x^{3}-x^{2}-3x=0$$$$x(x+1)\left(2x-3\right)=0$$$$x=-1 x=0 and x=1.5$$$$The zeros of f are -1 , 0 and 1.5$$ |
| **9.** | $$f\left(x\right)=x^{3}-6x^{2}-12x+8$$ |  |
|  |  | $$Graphically$$$$x -intercepts -2 $$$$ $$$$Algebraically $$$$f\left(x\right)=0$$$$x^{3}-6x^{2}-12x+8$$$$\left(x+2\right)\left(x+2\right)\left(x+2\right)=\left(x+2\right)^{3}$$$$x=-2 $$$$The zero of f is -2 $$ |

**Use the graph of each equation to test for symmetry with respect to the x -axis, y -axis, and the origin. Support the answer numerically. Then confirm algebraically.**

|  |  |  |
| --- | --- | --- |
| **10.** | $$y=\sqrt{x^{2}+2}$$ |  |
|  |  | **Graphically**The graph appears to be symmetric with respect to the $y$ –axis because for every point ***(***$x,y)$ on the graph, there is a point ($-x,y).$**Support Numerically**There is a table of values to support this conjecture.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| $$x$$ | $$-2$$ | $$-1$$ | $$0$$ | $$1$$ | $$2$$ |
| $$y$$ | $$\sqrt{6}$$ | $$\sqrt{3}$$ | $$\sqrt{2}$$ | $$\sqrt{3}$$ | $$\sqrt{6}$$ |
| $$(x,y)$$ | $$(-2,\sqrt{6})$$ | $$(-1,\sqrt{3})$$ | $$(0,\sqrt{2})$$ | $$(1,\sqrt{3})$$ | $$(2,\sqrt{6})$$ |

**Algebraically**Because$y=\sqrt{\left(-x\right)^{2}+2}$is equivalent to$\sqrt{x^{2}+2}$**,** the graphis symmetric with respect to the$y$ –axis**.** |
| **11.** | $$y=\sqrt[3]{x}$$ |  |
|  |  | **Graphically**The graph appears to be symmetric with respect to the **origin** because for every point ***(***$x,y)$ on the graph, there is a point ($-x,-y).$**Support Numerically**There is a table of values to support this conjecture.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| $$x$$ | $$-2$$ | $$-1$$ | $$0$$ | $$1$$ | $$2$$ |
| $$y$$ | $$-\sqrt[3]{2}$$ | $$-1$$ | $$0$$ | $$1$$ | $$\sqrt[3]{2}$$ |
| $$(x,y)$$ | $$(-2,-\sqrt[3]{2})$$ | $$(-1,-1)$$ | $$(0,0)$$ | $$(1,1)$$ | $$(2,\sqrt[3]{2})$$ |

**Algebraically**Because$-y=\sqrt[3]{-x}$is equivalent to$y=\sqrt[3]{x}$**,** the graphis symmetric with respect to the **origin.** |

|  |  |  |
| --- | --- | --- |
| **12.** | $$2x^{2}+3y^{2}=16$$ |  |
|  |  | **Graphically**The graph appears to be: * symmetric with respect to the $x$ -**axis** because for every point ***(***$x,y)$ on the graph, there is a point ($x,-y),$
* symmetric with respect to the $y$ -**axis** because for every point ***(***$x,y)$ on the graph, there is a point ($-x,y),$
* symmetric with respect to the **origin** because for every point ***(***$x,y)$ on the graph, there is a point ($-x,-y).$
 |
|  | **Symmetric with respect to** $ x$ -**axis** |  |
|  | **Algebraically**Because$2x^{2}+3\left(-y\right)^{2}=16$is equivalent to$ 2x^{2}+3y^{2}=16$ **,** the graphis symmetric with respect to $ x$ -**axis.** | **Support Numerically**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| $$x$$ | $$2$$ | $$2$$ | $$1$$ | $$1$$ |
| $$y$$ | $$\frac{2\sqrt{6}}{3}$$ | $$-\frac{2\sqrt{6}}{3}$$ | $$-\frac{\sqrt{42}}{3}$$ | $$\frac{\sqrt{42}}{3}$$ |
| $$(x,y)$$ | $$(2,\frac{2\sqrt{6}}{3})$$ | $$(2,-\frac{2\sqrt{6}}{3})$$ | $$(1,-\frac{\sqrt{42}}{3})$$ | $$(1,\frac{\sqrt{42}}{3})$$ |

 |
|  | **Symmetric with respect to** $ y$ -**axis** |  |
|  | **Algebraically**Because$2\left(-x\right)^{2}+3y^{2}=16$is equivalent to$2x^{2}+3y^{2}=16$ **,** the graphis symmetric with respect to the$ y$ –**axis.** | **Support Numerically**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| $$x$$ | $$-2$$ | $$-1$$ | $$1$$ | $$2$$ |
| $$y$$ | $$\frac{2\sqrt{6}}{3}$$ | $$\frac{\sqrt{42}}{3}$$ | $$\frac{\sqrt{42}}{3}$$ | $$\frac{2\sqrt{6}}{3}$$ |
| $$(x,y)$$ | $$(-2,\frac{2\sqrt{6}}{3})$$ | $$(-1,\frac{\sqrt{42}}{3})$$ | $$(1,\frac{\sqrt{42}}{3})$$ | $$(2,\frac{2\sqrt{6}}{3})$$ |

 |
|  | **Symmetric with respect to** **origin** |  |
|  | **Algebraically**Because$2\left(-x\right)^{2}+3\left(-y\right)^{2}=16$is equivalent to$ 2x^{2}+3y^{2}=16$ **,** the graphis symmetric with respect to the **origin.** | **Support Numerically**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| $$x$$ | $$-2$$ | $$-1$$ | $$1$$ | $$2$$ |
| $$y$$ | $$-\frac{2\sqrt{6}}{3}$$ | $$-\frac{\sqrt{42}}{3}$$ | $$\frac{\sqrt{42}}{3}$$ | $$\frac{2\sqrt{6}}{3}$$ |
| $$(x,y)$$ | $$(-2,-\frac{2\sqrt{6}}{3})$$ | $$(-1,-\frac{\sqrt{42}}{3})$$ | $$(1,\frac{\sqrt{42}}{3})$$ | $$(2,\frac{2\sqrt{6}}{3})$$ |

 |

**Determine whether the following are even, odd, or neither.**

|  |  |  |
| --- | --- | --- |
| **13.** | $$f\left(x\right)=x^{3}+2x$$ | $$f\left(x\right)=x^{3}+2x$$$$f\left(-x\right)=\left(-x\right)^{3}+2(-x)$$$$f\left(-x\right)=-x^{3}-2x$$$$f\left(-x\right)=-(x^{3}+2x)$$$f\left(-x\right)=-f\left(x\right)$ **The function is odd.** |
| **14.** | $g\left(t\right)=2t^{4}+t^{2}$ | $$g\left(t\right)=2t^{4}+t^{2}$$$$g\left(-t\right)=2\left(-t\right)^{4}+\left(-t\right)^{2}$$$$g\left(-t\right)=2t^{4}+t^{2}$$$g\left(-t\right)=g\left(t\right)$ **The function is even.** |
| **15.** | $$h\left(y\right)=y^{4}-5y^{2}-3y$$ | $$h\left(y\right)=y^{4}-5y^{2}-3y$$$$h\left(-y\right)=\left(-y\right)^{4}-5\left(-y\right)^{2}-3\left(-y\right)$$$$h\left(-y\right)=y^{4}-5y^{2}+3y$$$$h\left(-y\right)\ne h\left(y\right) h\left(-y\right)\ne -h\left(y\right)$$**The function is neither** |

**SOLVE REAL WORLD PROBLEM**

|  |  |
| --- | --- |
| **16.** | The temperature$T$in degrees Fahrenheit$ t$hours after 6 AM is given by$T\left(t\right)=-\frac{1}{2}t^{2}-8t+3, $$for 0<t<10.$Find $T\left(0\right)$**,** $T\left(2\right)$and$T\left(6\right) $graphically and algebraically. |
|  | **Graphically**$T\left(0\right)≈4 $$T\left(2\right)≈-11$ $T\left(6\right)≈-60$ | **Algebraically**$$T\left(0\right)=-\frac{1}{2}t^{2}-8t+3$$$$T\left(0\right)=-\frac{1}{2}\*0-8t\*0+3=3$$$$T\left(0\right)=3$$$$T\left(2\right)=-\frac{1}{2}\*2^{2}-8\*2+3$$$$T\left(2\right)=-\frac{1}{2}\*4-16+3$$$$T\left(2\right)=-2-16+3 $$$$T\left(2\right)=-15$$$$T\left(6\right)=-\frac{1}{2}6^{2}-8\*6+3$$$$T\left(6\right)=-\frac{1}{2}\*36-8\*6+3$$$$T\left(6\right)=-18-48+3$$$$T\left(6\right)=-63$$ |