1) Multiple Select. Which relations below are functions? **Select all that apply.**

A) $\{\left(-9, -7\right), \left(-9, 5\right), \left(1, 2\right), \left(5, -2\right), (10, -2)$

 B) $\{\left(4, -3\right), \left(7, -3\right), \left(0, 2\right), \left(7, -3\right), \left(11, 5\right)\}$

 C) $x^{2}+y^{2}=25$

 D) $y=-\sqrt{x+1}$

 E) F) G)

**For #2 – 3, evaluate each expression as indicated, and simplify.**

2)$f\left(x\right)=3x^{2}+2x-3;find f\left(x+4\right).$ 3) $g\left(x\right)=\frac{-2x^{2}+8}{x^{3}-2};find g\left(-6\right).$

**For #4 – 5, find the following information for each function.**

a) interval(s) increasing, in interval notation. b) interval(s) decreasing, in interval notation.

 c) Domain and Range, in interval notation. d) coordinates of any relative extrema.



4) 5)

**For #6 – 7, determine whether each function is even, odd, or neither.**

6) $f\left(x\right)=2x^{2}+x^{4}$ 7) $h\left(x\right)=x^{3}+x^{2}+3$

**For #8 – 9, evaluate each piecewise function at the indicated value.**

8) Find $g(-3)$ if $g\left(x\right)=\left\{\begin{array}{c}x+5 if x>1\\-\left(x+5\right) if x\leq 1\end{array}\right.$ 9) Find $h(3)$ if $h\left(x\right)=\left\{\begin{array}{c}\frac{x^{2}+4}{x-3} if x\ne 3\\x-1 if x=3\end{array}\right.$

**For #10 – 11: Graph each piecewise function.**

10) $f\left(x\right)=\left\{\begin{array}{c}x-1 if x<1\\-5 if x\geq 1\end{array}\right.$ 11) $g\left(x\right)= \left\{\begin{array}{c}2 if x<-3 \\\frac{1}{3}x-4 if-3\leq x\leq 0\\-2x+6 if x>0 \end{array}\right.$



12) Given that $f\left(x\right)=x^{2}+7x+5$, find $\frac{f\left(x+h\right)-f\left(x\right)}{h}$ given that $h\ne 0$. Simplify your answer fully.

**For #13 – 14, write the equation of each line in point-slope form, slope-int form,  *and* in** $(h, k)$ **form.**

13) Passes through $(1, -4)$ with an *x*-intercept at *x* = -1.

 14) Passes through $\left(8, -7\right) and (-4, -1)$

**For #15 – 19, given that** $f\left(x\right)=8x^{2}-5x$ **and** $g\left(x\right)=3x-6$**, find the requested value or expression.**

15) Find $f+g$. 16) Find $f\left(x\right)∙g\left(x\right).$

17) Find $\frac{f}{g}$ 18) Find $f\left(g\left(x\right)\right).$ In other words, find $\left(f∘g\right)\left(x\right).$

19) Find $f(g\left(11\right))$. In other words, find $\left(f∘g\right)\left(11\right).$

**For #20 – 21, Multiple Choice. Select the best answer.**

20) Find the functions $f$ and $g$ so that $h\left(x\right)=\left(f∘g\right)\left(x\right)$ given that $h\left(x\right)=\frac{6}{\sqrt{2x+9}}$

 A) $f\left(x\right)=\sqrt{2x+9};g\left(x\right)=6$ B) $f\left(x\right)=\frac{6}{x};g\left(x\right)=2x+9$

 C) $f\left(x\right)=6;g\left(x\right)=\sqrt{2+9}$ D) $f\left(x\right)=\frac{6}{\sqrt{x}};g\left(x\right)=2x+9$

21) Which two functions below are inverses of each other?

 $f\left(x\right)=\frac{x+3}{2}$ $g\left(x\right)=2x+3 $ $h\left(x\right)=\frac{x-3}{2}$

 A) $f\left(x\right) and h(x)$ B) $g\left(x\right) and h(x)$ C) $f\left(x\right) and g(x)$ D) None

22) Find the inverse of the one-to-one function: $f\left(x\right)=\frac{7x+8}{5}$

23) Does the graph represent a function that has an inverse function? Explain your reasoning.





24) Graph $f^{-1}$ given $f\left(x\right)$ as shown.

Also, find the domain and range of $f^{-1}$ in interval notation.

25) Given $f\left(x\right)=4x^{2}+2x+8$ and $g\left(x\right)=2x-3$, find $f\left(g\left(x\right)\right).$ In other words, find $\left(f∘g\right)\left(x\right).$

26) Given the graph of $f(x)$ as shown below. 27) Graph $y=-2\sqrt{x+3}$ below.

Graph $g(x)$ on the same coordinate system if

$$g\left(x\right)=-3f\left(x\right)+8$$



**Answers:**

1) B, D, E, G 2) $3x^{2}+26x+53$ 3) $\frac{32}{109}$

4) a. $(-\infty ,-2)∪(2,\infty )$, b. $(-2,2)$, c. D: $(-\infty ,\infty )$, R: $(-\infty ,\infty )$, d. R. Max: $(-2,18)$, R. Min: $(2,-14)$

5) a. $(-2,1)$, b. $(-4,-2)∪(1,6)$, c. D: $[-7,6)$, R: $[-5,4]$, d. R. Max: $(1,4)$, R. Min: $(-2,-5)$

6) Even 7) Neither 8) $g\left(-3\right)=-2$ 9) $h\left(3\right)=2$



10) 11) 12) $f\left(x\right)=2x+h+7$

|  |  |  |  |
| --- | --- | --- | --- |
| 13) | (h, k) Form | Point-Slope Form | Slope-Intercept Form |
|  | $$y=-2\left(x-1\right)-4$$ | $$y+4=-2\left(x-1\right)$$ | $$y=-2x-2$$ |
| OR | $$y=-2\left(x+1\right)$$ | $$y=-2\left(x+1\right)$$ |  |
| 14) | $$y=-\frac{1}{2}\left(x-8\right)-7$$ | $$y+7=-\frac{1}{2}\left(x-8\right)$$ | $$y=-\frac{1}{2}x-3$$ |
| OR | $$y=-\frac{1}{2}\left(x+4\right)-1$$ | $$y+1=-\frac{1}{2}\left(x+4\right)$$ |  |

15) $8x^{2}-2x-6$ 16) $24x^{3}-63x^{2}+30x$ 17) $\frac{8x^{2}-5x}{3x-6}$ or $\frac{x(8x-5)}{3(x-2)}$ 18) $72x^{2}-303x+318$

19) $f\left(g\left(11\right)\right)=5697$ 20) D 21) B 22) $y^{-1}=\frac{5x-8}{7}$ 23) No, doesn’t pass the horizontal line test.



24) D: $[-6,\infty )$, R: $[0,\infty )$ 25) $f\left(g\left(x\right)\right)=16x^{2}-44x+38$ 26)



 27)