

Show ALL your work to get full/partial credit. Each problem is worth 5 points.

For #s 1 and 2, $g(x) = (x - 1)^2 + 3$

- Write the parent function $f(x)$.

$$f(x) = x^2$$

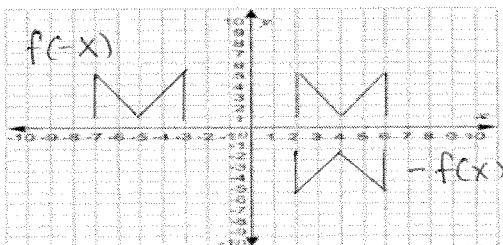
- Describe the transformations from $f(x)$ to graph $g(x)$.

(i) Shift the graph of x^2 to the right by 1 unit.
 (ii) Shift it upward by 3 units.

Refer to #s 3 and 4, given the graph of $y = f(x)$, sketch the following graphs and label the graph of each of the following functions individually.

3. $y = -f(x)$

4. $y = f(-x)$



Refer to #s 5 and 6, if $f(x) = \begin{cases} x + 2, & \text{for } x \leq 0 \\ x^2, & \text{for } x > 0 \end{cases}$

Evaluate

5. $f(-2)$. $f(x) = x + 2$
 $f(-2) = -2 + 2$
 $= 0$

6. $f(3)$. $f(x) = x^2$
 $f(3) = 3^2$
 $= 9$

- Explain whether the function, $h(x) = -x^4 + 3|x|$ is odd, even or neither.

$$h(x) = -x^4 + 3|x|$$

$$h(-x) = -(-x)^4 + 3|-x|$$

$$= -x^4 + 3|x|$$

$$= h(x)$$

$\therefore h$ is even.

(Refer to #s 8-10), if $f(x) = x^2 + 8x + 7$ and $g = \sqrt{2x}$. Find

8. $(f \circ g)(x)$

$$\begin{aligned} (f \circ g)(x) &= f(g(x)) \\ &= f(\sqrt{2x}) \\ &= \sqrt{2x}^2 + 8\sqrt{2x} + 7 \\ &= 2x + 8\sqrt{2x} + 7 \end{aligned}$$

9. The domain $(f \circ g)(x)$

$$\begin{aligned} 2x &\geq 0 \\ x &\geq 0 \\ \text{Domain} &= [0, \infty) \end{aligned}$$

10. $f(g(8))$. $f(g(8)) = 2(8) + 8\sqrt{2(8)} + 7$
 $= 16 + 8\sqrt{16} + 7$
 $= 16 + 8(4) + 7 = 16 + 32 + 7 = 55$

Refer to #s 11-14, given $f(x) = x^2 + 8x + 7$

11. State whether (and why) the graph of the parabola opens upward or downward.

Opens upward because the coefficient of x^2 term is positive.

12. Find the vertex of the parabola using the vertex formula.

$$\text{vertex} = \left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right) \right)$$

$$a=1, b=8$$

$$\frac{-b}{2a} = \frac{-8}{2} = -4$$

$$\begin{aligned} f(-4) &= (-4)^2 + 8(-4) + 7 \\ &= 16 - 32 + 7 \\ &= -9 \end{aligned}$$

$$\text{vertex} = (-4, -9)$$

13. Identify the x-intercepts.

$$\text{Set } f(x) = 0 \Rightarrow x^2 + 8x + 7 = 0$$

$$(x+7)(x+1) = 0$$

$$x+7=0 \text{ or } x+1=0 \Rightarrow x=-7, x=-1$$

$$(-7, 0), (-1, 0)$$

14. Identify the y-intercept.

$$\text{Set } x=0.$$

$$f(0) = 0^2 + 8(0) + 7$$

$$= 7 \quad (0, 7)$$

15. Find the difference quotient, $\frac{f(x+h)-f(x)}{h}$, if $f(x) = 2x + 4$.

$$f(x+h) = 2(x+h) + 4$$

$$= 2x + 2h + 4$$

$$\text{Difference Quotient} = \frac{f(x+h) - f(x)}{h}$$

$$= \frac{2x + 2h + 4 - (2x + 4)}{h}$$

$$= \frac{\cancel{2x} + 2h + \cancel{4} - \cancel{2x} - \cancel{4}}{h}$$

$$= \frac{2h}{h}$$

$$= \boxed{2}$$

Explain whether the given expression (#s 16 and 17) is a polynomial or not?

16. $f(x) = 4^x - 3x^2 + 1$

No

The term 4^x has a coefficient which is not necessarily a whole number

17. $f(x) = x^5 - 3x^2 + \sqrt{5}$.

Yes.

The exponents are whole numbers.
coefficients are real numbers.

Refer to #s 18-20, if $f(x) = x^5 - 10x^4 + 25x^3$,

18. Find the zeros of the function.

$$\begin{aligned} f(x) &= x^5 - 10x^4 + 25x^3 \\ &= x^3(x^2 - 10x + 25) \\ &= x^3(x-5)^2 \end{aligned}$$

Zeros		Multiplicities
0	→	3
5	→	2

Zeros are 0 and 5.

19. State the multiplicities of the function.

Zeros		Multiplicities
0	→	3
5	→	2

20. Determine the end behavior of the function.



Up to the right
down to the left.