Name: $\qquad$ Points: $\qquad$

Part I Using software to graph

1. Use Desmos to graph
the line: $y=x$
the parabola: $y=x^{2}$
the circle: $x^{2}+y^{2}=4$
2. Setting up an account so you can save your graph at any time. You will be using the graphs later in Part III.
3. Replace $x$ with $(x-a)$ in each equation. Add a slider.

What happens if $a=10$ ? What happens if $a=-10$ ? More generally, describe what happens as $a$ changes?
4. Replace $y$ with $(y-b)$ in each equation. Guess what happens as $b$ changes?
5. Add a slider. What happens if $b=10$ ? What happens if $b=-10$ ?

More generally, what happens as $b$ changes? Is this what you thought would happen?
6. Does this agree with what you know about the graphs of $y=x-5$ and $y=x+3$ (or, written differently, $y-3=x)$ ? What about $y=x+5$ ?

## Part II

7. Predict what the graph of $(x+2)^{2}+25(y-3)^{2}=25$ looks like. Draw a sketch here:
8. Check your answer using Desmos. If you didn't get the same answer, explain the difference.
9. What is the equation for the graph obtained from the graph in number 7 by shifting it down 2 units and to the right 1 unit.
10. Check your answer using Desmos.
11. The equation for a basic parabola with vertex $(0,0)$, opening up is $y=x^{2}$ (see number 1 ). Write an equation of a parabola with vertex $(2,-3)$ opening upward.
12. Write the equation of a circle Centered at ( $-3,5$ ) with radius 4 .
13. You can check your answers using Desmos

## PART III

14. Repeat number 1 in part I (or recall the saved graphs).
15. Consider replacing $y$ by $c y$ using a slider
16. Take $c=-4,-2,-1,-\frac{1}{2},-\frac{1}{4}, \frac{1}{4}, \frac{1}{2}, 1,2,4$. What happened to the graph for each value of $c$ ?
17. Explain what happens as c changes, in general?
18. Do the same for $x$ : (take replace $x$ with $(d x)$ and add a slider). Predict what happens to the graph for different values of $d$.
19. Take $d=-4,-2,-1,-\frac{1}{2},-\frac{1}{4}, \frac{1}{4}, \frac{1}{2}, 1,2,4$ Did this match your predictions?
20. Check your answer with Desmos.
21. Write down the equation for the parabola that looks like the one in number 1 but opening downward instead (reflect about the $x$-axis). After you have done this, check your answer with Desmos.
22. Guess what the graph of $y=2(x+3)^{2}-4$ looks like. And what about $y=-2(x+3)^{2}-4$ ?
23. Check your answers with Desmos.
