PC11 Quadratic Assignment

Name: _____

1. $y = x^2$
   a. Sketch and label three points

   b. Domain?

   c. Range?

   d. Coordinates of the vertex?

   e. Equation of the line of symmetry?

2. $f(x) = x^2 - 9$
   a. Sketch and label three points

   b. Range?

   c. Evaluate $f(-2)$

   d. Intercepts?

3. Basic Transformations:
   $f(x) = x^2$ and $g(x) = f(x) - 4$

   a. What is the actual equation of $g(x)$?

   b. Sketch $g(x)$

4. Given $y = f(x) + k$, what is the transforming effect of k on the graph $y = f(x)$?

5. Sketch the quadratic:
   a. $h(x) = (x - 2)^2$

   b. $y = (x + 1)^2 - 3$

   c. $y = -(x - 2)^2 + 3$

   d. $h(t) = -t^2$

6. $z(x) = 2(x - 3)^2 + 1$

    a. Create a table of values for the function $z(x)$

    b. Use these points to graph $z(x)$

    c. Find the z-intercept

7. Sketch $y = -2(x - 1)^2 + 3$

8. $f(x) = \frac{1}{2}(x + 1)^2$

    a. Sketch $y = f(x)$

    b. Evaluate $f(1)$

9. $y = a(x \pm b)^2 \pm c$. In general, what are the effects of parameters $a, b,$ and c?

10. Enrichment: $y = af(b(x \pm c)) \pm d$. In general, what are the effects of parameters $a, b, c,$ and d?

11. Enrichment: $f(x) = x^2$. $g(x) = 9f(x)$ and $h(x) = f(3x)$. Show that $g(x) = h(x)$.

12. Solve a factored Quadratic:
    Find the x-intercepts: $y = (x - 2)(2x + 1)$

13. Solve a quadratic that only has one solution:
    Find the x-intercept: $y = 2x^2 - 12x + 18$

14. Find the x-intercepts using algebra: $y = 12 - 3x^2$

15. Solve $x^2 = 2x + 8$
   a. Graphically by sketching two graphs

   b. Graphically by sketching one graph

   c. Algebraically

16. Find the coordinates of the point of intersection:
   $f(x) = (x - 2)^2$ and $g(x) = -(x + 1)^2 + 5$

17. Complete the square and identify the coordinates of the vertex:
   a. $y = x^2 + 4x + 1$

   b. $y = x^2 - 2x$

c. $y = 2x^2 + 8x - 3$

d. $y = x^2 + x - 2$

e. $y = 3x^2 + 6x - 1$

f. $y = \frac{2}{3}x^2 + \frac{x}{2} - 3$

18. Solve x by completing the square:

a. $y = x^2 + 6x - 3$

b. $y = 3x^2 - 6x - 1$

19. Enrichment:
   a. Show that $x = -\dfrac{b}{2a}$ is the equation of the line of symmetry

   b. Show that the roots of a quadratic function are $x = \dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ by completing the square on $y = ax^2 + bx + c$

20. $f(x) = x^2 - 4x$
   a. Solve by factoring

   b. Solve by using the quadratic formula

   c. Solve by completing the square

21. Simplify $\dfrac{-4 \pm \sqrt{8}}{-2}$

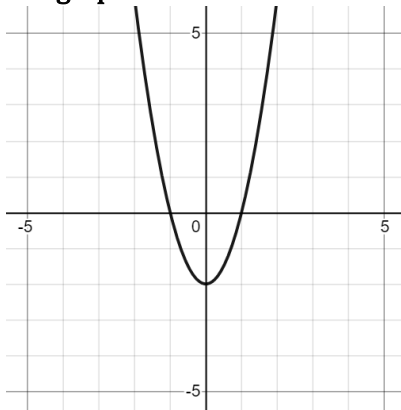22. Solve a quadratic that cannot be factored:

$y = 3x^2 + 2x - 4$

23. Attempt to solve a quadratic that has no roots:

Solve $y = x^2 + 3x + 3$

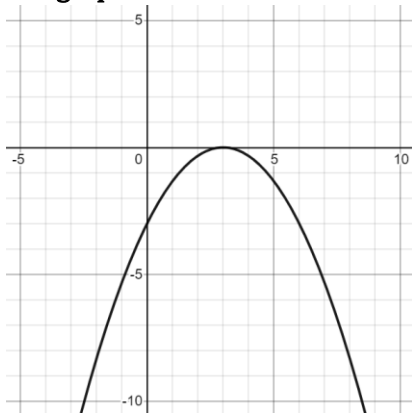24. Find the equation of the parabola:
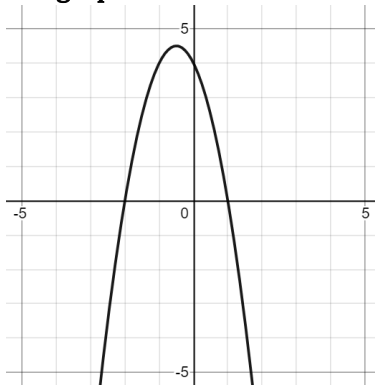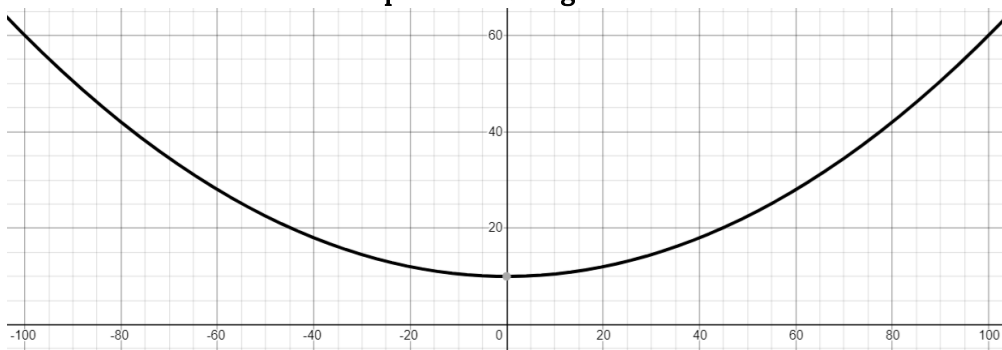   a. See graph below:
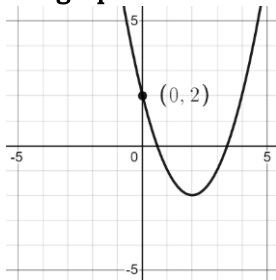
   b. See graph below:

c. See graph below:

d. See graph below:

25. Find the exact formula for the parabolic bridge cable below:

26. What is the equation of the parabola that:

    a.   has a vertex of $(1, 2)$ and has a y-intercept of 4?

    b.   has a vertex of $(2, 1)$ and contains the point $\left(4, -\frac{1}{3}\right)$?

27. Height (in metres) is a function of time (in seconds). On planet Z, $h(t) = -(t - 2)^2 + 10$ models your height jumping off a cliff into water.

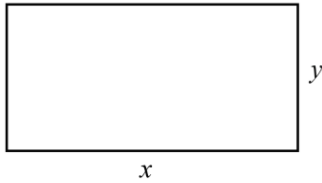   a.   What is your initial height?

    b.   When do you reach your maximum height?

    c.   What is the maximum height that you achieve?

    d.   After you jump, for how long are you above the height of 6 metres?
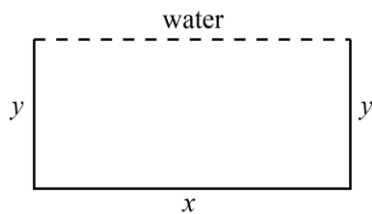
    e.   When do you land in the water?

28. You have 250 metres of fencing. Find the maximum possible rectangular area.

29. You have 1000 m to fence off your plot of land which is adjacent to a lake. Fencing is only used on three sides of your property because of the water.

a.   What dimensions should be used to maximize the area of your land?

b.   What is the maximum possible area?

c.   What is the minimum possible area?

d.   In the context of this problem, why is maximizing area not your primary concern?

30. You have 1200 feet of fencing to enclose two adjacent rectangular regions of equal lengths and widths as shown in the diagram below. What is the maximum area that can be enclosed in the fencing?

y

x

31. You have 300 m of fencing. Find x and y to maximize the area of the yard. Only the thick blue border is fenced.

60 m

BARN

x

YARD

y
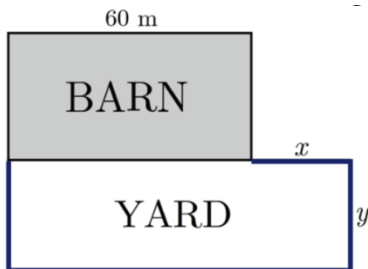
32. The shortest cable in the bridge below is $a = 10$. Find length b.

60

b

a

200
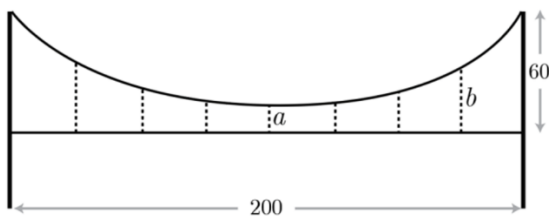
33. You sell 3000 phone cases each month at a price of $20. For each $1 price increase, you sell 100 less phone cases.
   a. What price should you set to maximize revenue?

   b. What is the maximum revenue?

   c. How many phone cases are sold when revenue is maximized?

34. Challenge: A square shaped truck squeezes into the parabola shaped tunnel below. What is the exact value of the maximum width of the truck?
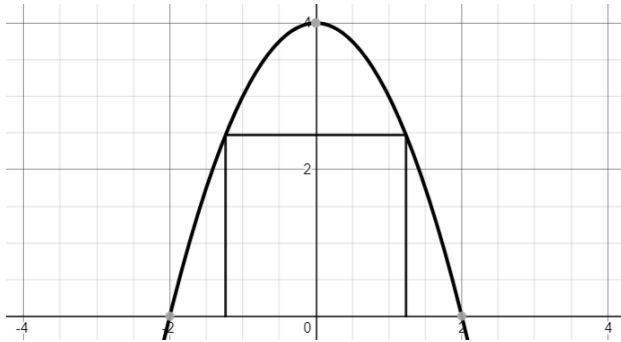
35. Enrichment – find the discriminant:

    a. $y = x^2 + 2x - 8$

    b. $y = 2x^2 - (k + 1)x + k + 1$

36. Challenge: The quadratic curves with equations $y = x^2 - 4x + 5$ and $y = m + 2x - x^2$ where m is a constant, touch once at the point P. Determine the coordinates of P.