Quadratic Functions & Equations MSIP Assignment

1. Graph the function $f(x) = 2(x - 2)^2 + 5$. Label the vertex and axis of symmetry.

2. A quadratic function has these characteristics:
   $x = 1$ is the equation for the axis of symmetry.
   $x = -1$ is an x-intercept.
   $y = -4$ is the minimum value.
   Determine the y-intercept of this parabola.

3. At a baseball game, workers toss T-shirts to spectators in the stands out of a sling-shot. The height of a T-shirt is modelled by the function $h(t) = -5t^2 + 20t + 1$ where $h(t)$ is height in metres and t is the time in seconds after the toss. What is the maximum height of the T-shirt if it is not caught? How much time does it take the T-shirt to reach maximum height?

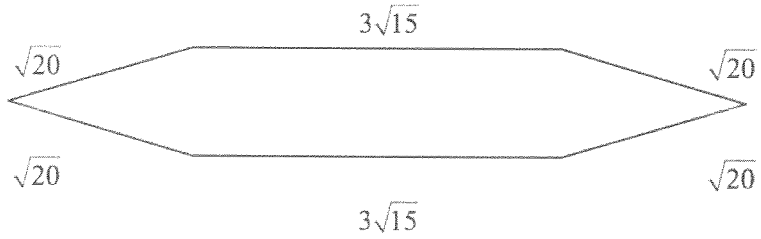
4. Christine has a 180-cm strip of wood to make a frame. Determine a function to represent the area of the frame, $f(x)$, based on the length of the frame, x. What is the maximum area Christine can make for the frame?

5. Travis and Laura are rock climbing. Travis throws a spike to Laura. The function $h(t) = -5t^2 + 20t + 110$ models the height of the spike in metres above the ground at time t. Laura is 135 m above the ground. Did Travis' throw reach Laura? Explain your answer.

6. Given $f(x) = -3x^2 + 6x + 7$, determine the equation of the inverse. Explain how you found your answer.

7. Given $f(x) = -4x^2 - 56x - 207$, determine $f^{-1}(-15)$. Explain how you found your answer.

8. Calculate the perimeter. Leave your answer in simplest form.



9. Simplify $\left(7 + \sqrt{50}\right)\left(-9 - \sqrt{32}\right)$.

10. Simplify.
    $3\sqrt{2}\left(6\sqrt{6} - \sqrt{10}\right) - 12\sqrt{3}$

11. Neal dropped a small stone off a bridge that is 21 m above the water. The height of the stone is given by the function $h(t) = -4.9t^2 + x + 21$, where $h(t)$ is the height in metres and t is the time in seconds. How long will it take for the stone to hit the water?

12. For what value(s) of k will the function $h(x) = 4x^2 - kx + 25$ have only one zero? Explain your answer.

13. Determine the equation of the parabola with x-intercepts $\pm\sqrt{13}$, and that passes through $(-5, -4)$. Explain how you found your answer.

14. Determine the equation of the parabola with vertex (–6, –6) and that passes through (3, –10). Explain how you found your answer.

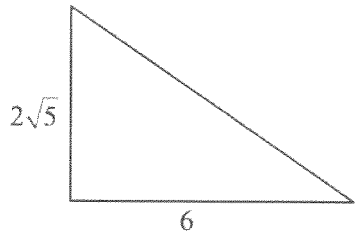
15. Stan is making an arch at the top of his barn doors. The arch has a shape that can be modelled by the equation of a parabola. If the left edge of the door is the origin and the doorway is 6 m wide, what is the equation of the parabola if the height of the arch 2 m from the edge of the doorway is 5 m?

16. Determine the equation of the parabola that passes through (1, –2) if its zeros are $3 + \sqrt{5}$ and $3 - \sqrt{5}$. Explain how you found your answer.

17. Determine the point(s) of intersection of the functions $f(x) = -3x^2 + 6x + 4$ and $g(x) = 3x - 2$ by graphing. Explain your answer.

18. Shondra has 120 m of fencing to enclose a rectangular pen for a children's play area. She will further divide the area by putting another fence across the pen. (So there are now 2 rectangular play areas in the pen)
    a) Determine a function to represent the area of the playground.
    b) Determine the maximum area for the pen.
    c) Determine the measurements for the length and width of the rectangle with the maximum area.

19. What is the length of the hypotenuse for the triangle shown? Write your answer in simplest form.



20. A square has an area of 675 m^2. What is the length of a side in simplest form? Explain how you found your answer.

21. A rectangular pool is to be built on a lot that measures 20 m by 12 m. A wooden deck of uniform width, equal to the area of the pool, must surround it.
    a) How wide is the strip of the deck?
    b) What are the length and width of the pool?

22. Determine the number of zeros of the function $f(x) = 7 - (x - 5)(4x - 2)$ without solving the related quadratic equation or graphing. Explain your thinking.

23. A highway tunnel has a shape that can be modelled by the equation of a parabola. The tunnel is 18 m wide and the height of the tunnel 16 m from the edge is 5 m.
    a) Determine the equation of the parabola.
    b) Sketch a graph of your parabola.
    c) Can a truck that is 8 m tall and 4 m wide pass through the tunnel? Justify your decision.

24. Gloria is skeet shooting. The height of the skeet is modelled by the function $h(t) = -4.9t^2 + 32t + 2$, where $h(t)$ is the height in metres after t seconds. The path of Gloria's pellet is modelled by the function $g(t) = 28.5t + 1$, with the same units.
    a) How high off the ground will the skeet be when it is hit?
    b) After how many seconds will the skeet be hit?