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## Math 9 Trimester (125 points)

### *Functions*

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■ Unless a question specifically states otherwise, all answers must be exact. Answers must be in correct mathematical notation.

■ A. Answer the following. (2 points each answer)

[1] A function  $f$  is defined by  $f(x) = 3(x - 5)^2 - 1$

[a] Is the graph of  $f$  concave up or concave down?

[b] Check [Yes] or [No]

[Yes] [No]  $f$  has a maximum value.

[Yes] [No]  $f$  has a minimum value.

[c] If  $f$  has a maximum or a minimum, then at what point does the max or min occur?

[d] Where is the function increasing?

[e] Where is the function decreasing?

[f] What is the equation of the function's line of symmetry?

[2] A function  $f$  is defined by  $f(x) = -(x + 2)^2 + 7$

[a] Is the graph of  $f$  concave up or concave down?

[b] Check [Yes] or [No]

[Yes] [No]  $f$  has a maximum value.

[Yes] [No]  $f$  has a minimum value.

[c] If  $f$  has a maximum or a minimum, then at what point does the max or min occur?

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[f] What is the equation of the function's line of symmetry?

- B. For each function below, rewrite it in the form  $f(x) = \pm a(x \pm b)^2 \pm c$ . That is, complete the square. (10 points each answer)

[1]  $f(x) = x^2 + 6x + 8$

[2]  $f(x) = 2x^2 + 12x + 17$

[3]  $f(x) = -x^2 - 2\sqrt{3}x - 2$

■ C. Consider  $f : f(x) = -2x^2 - 20x - 56$ . (3 points each answer)

[a] Is the graph of  $f$  concave up or concave down?

[b] Check [Yes] or [No]

[Yes] [No]  $f$  has a maximum value.

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[c] If  $f$  has a maximum or a minimum, then at what point does the max or min occur?

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[f] What is the equation of the function's line of symmetry?

- D. Find the zeros of each of the following functions. If the function has no real zeros, then say so. Only exact answers count. (15 points each answer)

[1]  $f(x) = x^2 + x - 6$

[2]  $f(x) = x^2 - 3x - 1$

■ E. Answer the following. (6 points each answer)

[1] State the domain of  $f(x) = \frac{2}{x+5}$

[2] State the domain of  $f(x) = \sqrt{3-x}$

[3] State the domain of  $f(x) = \frac{1}{x^2+5x+6}$

■ F. Answer the following. (5 points)

A quadratic function has a minimum at  $(3, -5)$ . Its graph crosses the x-axis at  $(-1, 0)$  and  $(7, 0)$ . Write this function in the form  $f(x) = \pm a(x \pm b)^2 \pm c$ .

## Answers

■ A. Answer the following. (2 points each answer)

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*In[27]:=* Expand[ (x - 1 +  $\sqrt{2}$ ) (x - 1 -  $\sqrt{2}$ ) ]

*Out[27]=*  $x^2 - 2x - 1$