

1. (8pts) The quadratic function  $f(x) = -x^2 - 2x + 8$  is given. Do the following without using the calculator.
- Find the  $x$ -intercepts of its graph, if any.
  - Find the vertex of the graph.
  - Sketch the graph of the function.
  - What is the range of the function?

2. (2pts) The table gives values of  $f$  and  $g$  for some  $x$ 's. Find  $(g \circ f)(2)$  and  $(f \circ f)(3)$ .

$x$	1	2	3
$f(x)$	1	2	1
$g(x)$	3	1	2

3. (5pts) Let  $f(x) = x^2 + 5$  and  $g(x) = \sqrt{x - 7}$ . Find the following composites (simplify if possible):

$$(f \circ g)(x) =$$

$$(g \circ g)(x) =$$

4. (3pts) Let  $h(x) = |3x + 5|$ . Break up this function into a composite of two functions  $f$  and  $g$ . That is, find  $f$  and  $g$  so that  $h(x) = (f \circ g)(x)$ .

5. (11pts) Consider the polynomial  $P(x) = (x + 1)(x - 4)(x - 6)$ . Answer the following (decimal answers should have accuracy to two decimal places).

- Find the  $x$ -intercepts of the graph and the  $y$ -intercept.
- $P$  behaves like what function for large  $|x|$ ?
- Find the turning points of  $P$ .
- Sketch the graph of the function on paper. Make sure scale is marked and all features you found in a)-c) are indicated.
- Use the graph to determine where the function is decreasing.

6. (2pts) Write a formula for a polynomial of degree 4 whose zeroes are 1 (multiplicity 3) and 7 (multiplicity 1).

7. (11pts) Consider the rational function  $Q(x) = \frac{x^2 - 3x - 10}{3x + 5}$ .

Answer the following (decimal answers should have accuracy to two decimal places).

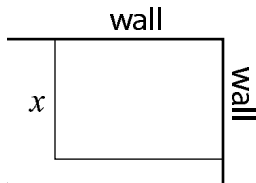
- Find the domain of the function and where the vertical asymptotes are.
- Find the  $x$ -intercepts of the graph and the  $y$ -intercept.
- Find the horizontal asymptote, if any.
- Sketch the graph of the function on paper. Make sure scale is marked and all features you found in a)-c) are indicated.
- Find the intervals where the function is decreasing.

8. (8pts) Shannon has 100ft of fencing to enclose a rectangular play pen. Two sides of the pen are walls (see picture) and fence is used for the remaining two sides.

a) Express the area  $A$  of the play pen as a function of the width  $x$ .

b) Draw an accurate graph of the function  $A(x)$ .

c) For what  $x$  is the area the largest? What is the maximum area?



**Bonus** (5pts) Find the formula for a rational function whose graph is shown. (Hint: what will give you the correct vertical asymptotes? The correct  $x$ -intercepts?)

