By providing my signature below I acknowledge that I abide by the University's academic honesty policy. This is my work, and I did not get any help from anyone else during the exam:

Name (sign): _____ Name (print): _____

Student Number: _____

Instructor's Name: _____ Class Time: _____

Problem Number	Points Possible	Points Made
1	0	
2	15	
3	15	
4	10	
5	20	
6	15	
7	15	
8	10	
Total:	100	

- If you need extra space use the last page.
- Please show your work. **An unjustified answer may receive little or no credit.**
- If you make use of a theorem to justify a conclusion then state the theorem used by name.
- Your work must be **neat**. This will make it easier to properly grade and give you the credit you deserve.
- The total number of possible points that is assigned for each problem is shown here. The number of points for each subproblem is shown within the exam.
- Please turn off your mobile phone.
- A calculator is not necessary, but numerical answers should be given in a form that can be directly entered into a calculator.
- Common identities:

$$\begin{aligned}\cos(\alpha+\beta) &= \cos(\alpha)\cos(\beta)-\sin(\alpha)\sin(\beta),\\ \sin(\alpha+\beta) &= \sin(\alpha)\cos(\beta)+\cos(\alpha)\sin(\beta).\end{aligned}$$

1. [2 Bonus] Common Knowledge: How will Lidl-Trek adapt after their best time trialer, Ellen van Dijk, retires after this season?

2. Determine all of the values of x for each question below that satisfy the given equation. If no values of x satisfy the equation provide a brief justification as to how you arrived at your conclusion.

   (a) [5 pts] $\sqrt{3-x} = 5$.

   (b) [5 pts] $\dfrac{3}{5-x} = \dfrac{2}{x+8}$.

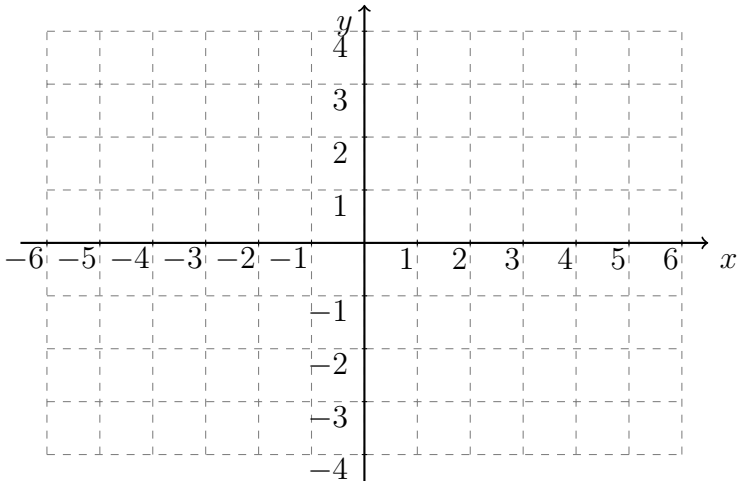
   (c) [5 pts] $\sqrt{x-1} = 4 - x$.

3. Given the function,

$$p(x) = -4|x-3|+2,$$

answer each of the following questions.

(a) [5 pts] Use the axes below to make a sketch of the graph of $p(x)$.

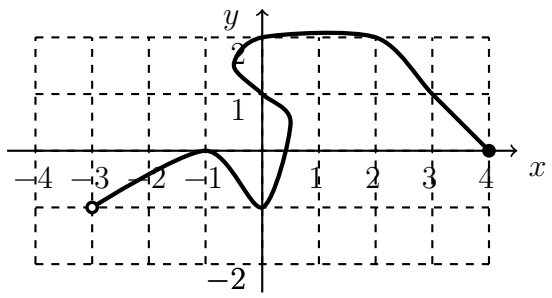


(b) [5 pts] Determine the domain and range of $p(x)$.

(c) [5 pts] If $g(x) = 1$ determine all possible values of x that will make this true.

4. [10 pts] A turtle starts at the origin and walks in a straight line. The turtle walks a distance of ten meters and ends up at the coordinate $Q(x, 4)$. Determine all possible values of x. (Make a rough sketch and label the important aspects.)

5. Three relationships are given below.



$$g(x) = x - x^2,$$

$$h(x) = \begin{cases} -x - 2 & -2 < x < -1, \\ 2\sqrt{x-1} - 3 & 1 \leq x \leq 4. \end{cases}$$

(a) [5 pts] For the relationship whose graph is given on the furthest left state whether or not it is a function. Provide a brief justification and do not simply state that it passes a given "test."

(b) [5 pts] Determine the x and y-intercepts for the function $g(x)$. (Your answers should be a set of coordinates.)

(c) [5 pts] Determine the x and y-intercepts for the function $h(x)$. (Your answers should be a set of coordinates.)

(d) [5 pts] Determine the values of $g(h(2))$ and $h(g(2))$.

6. Determine the formulas for the functions described in each part below.

   (a) [5 pts] The total perimeter of a rectangle will be 3 metres. Determine a function that will return the width of the rectangle given its height.

   (b) [5 pts] A company will make an advertisement available to clients, and the advertisement will be in the shape of a rectangle with a total area of 10 m^2. Determine a function that will return the height of the advertisement given its width.

   (c) [5 pts] Bread flour will be mixed with rye flour, and the total mass of the result will be $\frac{1}{2}$ kg. Determine a function that will return the mass of rye flour given the mass of the bread flour used.

7. Salt is added to water to form a solution. The boiling point of the solution is a linear function of the concentration of salt.

   (a) [10 pts] When the concentration of the salt is 0.03 g/ml the boiling point is 101.5 C. When the concentration of the salt is 0.08 g/ml the boiling point is 102.1 C. Determine the function that returns the boiling point given the concentration.

   (b) [5 pts] What concentration is required for the boiling point to be 103.3 C?

8. [10 pts] Two types of fungus are present in a patch of soil. The total sum of the mass of the fungi will add to 500g. Each fungus decomposes nutrients found in the patch, but the rate of decomposition depends on how much of the fungus is present.

   Fungus 1 The rate of decay associated with fungus 1 is $(500 - x)$ g/day, where x is the total mass of fungus 1 present.

   Fungus 2 The rate of decay associated with fungus 2 is $(800 - 2y)$ g/day, where y is the total mass of fungus 2 present.

   The total rate of decay is the **product** of the rate for fungus 1 and the rate for fungus 2. What amount of fungus 1 and fungus 2 will result in the highest total rate of decay?

Extra space for work. **Do not detach this page.** If you want us to consider the work on this page you should print your name, instructor and class meeting time below.

Name (print): _____ Instructor (print): _____ Time: _____