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	10	
4	17	
5	15	
6	18	
7	10	
8	15	
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**. If I can't read it (or can't find it), I can't grade it.
- 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: Was Maryanne Vos' disqualification for using the puppy paws position at the Postnord Vårgårda WestSweden road race fair?

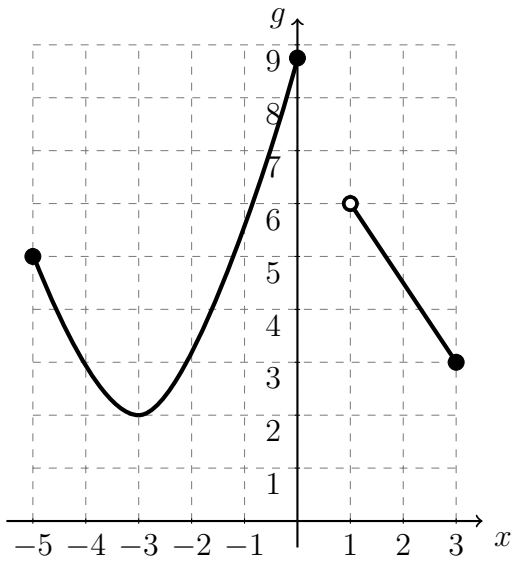
2. Determine all of the values of x for each question below that satisfy the given equation. If no values of x satisfy the equation provide a brief justification as to how you arrived at your conclusion.

(a) [5 pts] $\dfrac{3}{5+x} = \dfrac{7}{6-x}$.

(b) [5 pts] $|2x+1| = 3$.

(c) [5 pts] $(x+4)^2 + x = 1$

3. The questions below refer to the function whose graph is shown in the figure below.



_____ (a) [5 pts] Determine the formula for the function and express it as a piecewise defined function. (The curved part is a parabola.)

_____ (b) [5 pts] Determine the parts of the domain where the function is increasing and where it is decreasing.

4. Two functions are given below, and a is a constant. Determine the values of the quantities given below. If a quantity does not exist provide an explanation to justify your conclusion.

$$g(x) = \begin{cases} x & 0 \leq x < 2, \\ x+1 & 2 < x \leq 4, \end{cases} \qquad h(x) = a(x-3)^2 - 6.$$

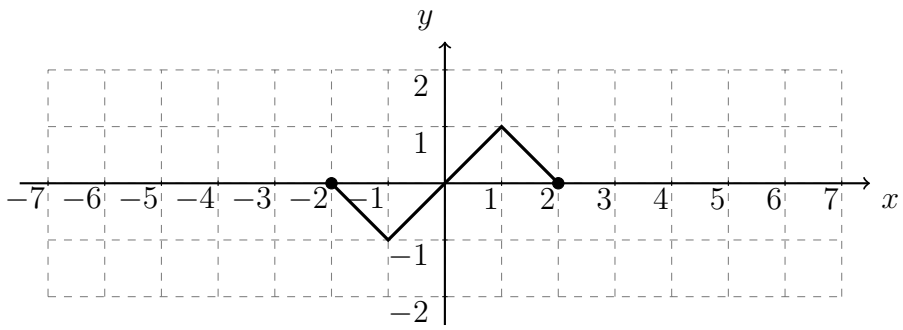
(a) [5 pts] Determine the value of $g(h(3))$.

(b) [5 pts] Given that $h(g(3)) = 5$, determine the value of a.

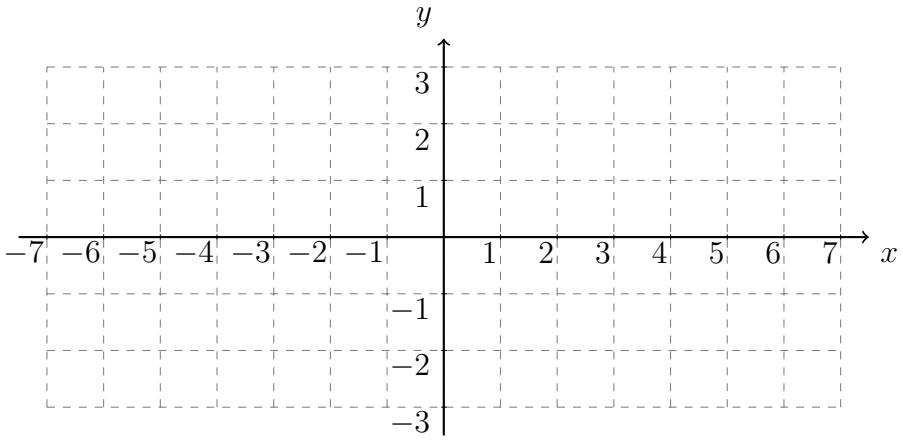
(c) [5 pts] Using your value of a determine the value of $h(g(1))$.

(d) [2 pts] For what values of x is $h(g(x))$ increasing?

5. The questions below refer to the function $f(x)$ whose graph is given below:



_____ (a) [10 pts] Use the axes below to sketch a graph of the function $f\left(\frac{1}{2}x + 1\right) - 1$.



_____ (b) [5 pts] Determine the values of a, b, c, and d so that the function

$$c(x) \;=\; af(bx + c) + d.$$

will transform f in the following order:

1. compress it horizontally by a factor of 3,
2. shift it left 2 units,
3. shift it up 5 units.

6. The depth of a pond is three meters deep when it starts to rain, and the depth of the pond increases 0.04 meters each hour.

(a) [6 pts] Determine a formula for the depth of the pond given the number of hours since the rain started.

(b) [6 pts] What will the depth of the pond at the end of one day?

(c) [6 pts] At what time will the depth of the pond be 3.15 meters?

7. Two trees are identified, and their positions relative to a fire tower are recorded. Tree one is 50 meters west and 120 meters north of the tower. Tree two is 75 meters west and 150 meters north of the tower.

_____ (a) [5 pts] What is the distance between the two trees?

(b) [5 pts] A third tree is identified. The tree's location is 60 meters west of the tower, and the tree is north of tree one. The distance between the third tree and tree one is 50 meters. What is the location of the third tree?

_____

8. [15 pts] The interface for an electronic device will consist of two rectangular parts with the same dimensions, and one rectangle will be aligned directly above the other. There will be a fancy border around the outside of the whole interface as well as between the two rectangles. The cost of the border will be twenty-five cents per centimetre, and the total budget for the border will be five dollars. Determine the dimensions that will maximize the total area of the interface.

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: _____