

Print and sign a brief statement stating this is your work and you used no other resource:

Name (sign): \_\_\_\_\_

Name (print): \_\_\_\_\_

Student Number: \_\_\_\_\_

Instructor's Name: \_\_\_\_\_

Class Time: \_\_\_\_\_

| Problem Number | Points Possible | Points Made |
|----------------|-----------------|-------------|
| ??             | 0               |             |
| ??             | 15              |             |
| ??             | 10              |             |
| ??             | 13              |             |
| ??             | 12              |             |
| ??             | 15              |             |
| ??             | 15              |             |
| ??             | 10              |             |
| ??             | 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**. 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:

$$\cos(\alpha + \beta) = \cos(\alpha) \cos(\beta) - \sin(\alpha) \sin(\beta), \quad \sin(\alpha + \beta) = \sin(\alpha) \cos(\beta) + \cos(\alpha) \sin(\beta).$$

1. Common Knowledge: Who was the best hockey player in the decade from 2010 to 2019?

(a)

2. Determine all of the values of  $x$  for each question below that satisfy the given equation.

$$\frac{7x + 4}{3x - 1} = 4$$

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(b)

$$\frac{1}{3x + 1} = x$$

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(c)

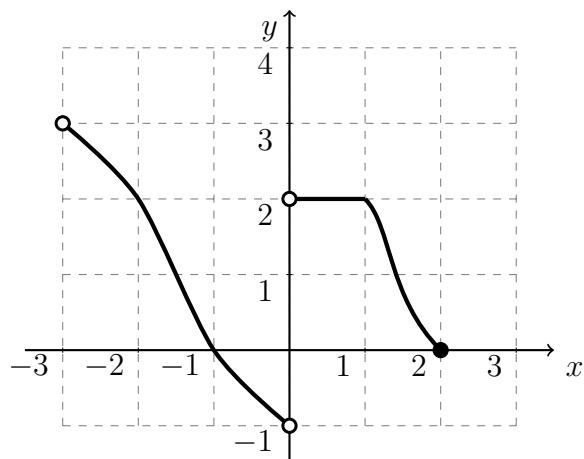
$$\sqrt{7 - x^2} = 2$$

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(a)

3. Determine the domain and range for each of the functions given below.

The function  $g(x)$  whose graph can be found below.



(b)

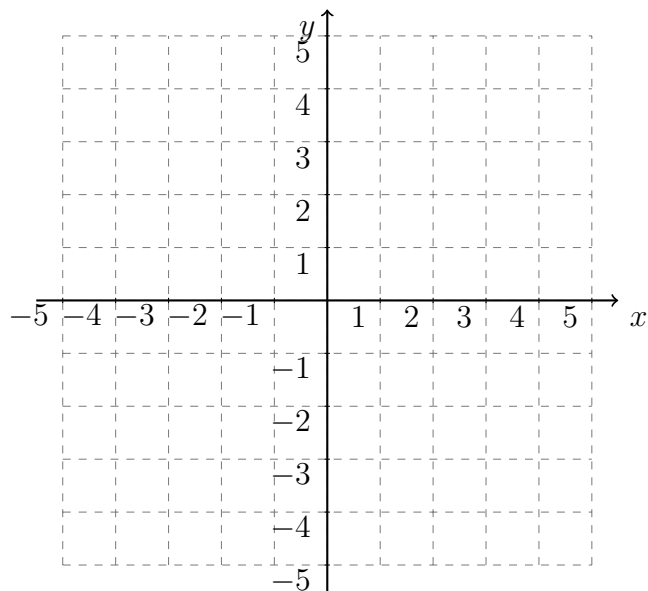
$$k(x) = \begin{cases} 2 + x, & -2 \leq x \leq 0, \\ 5 - x, & 0 < x < 3. \end{cases}$$

4. The questions below refer to the function

$$b(x) = \frac{1}{2}x^2 + 3x - \frac{1}{2}.$$

(a)

Sketch the function using the axes below.



(b)

Determine the values of  $x$  where the function is increasing and also determine the values of  $x$  where the function is decreasing.

(c)

Determine any coordinates that represent a local minimum or a local maximum.

5. Three functions,  $h$ ,  $f$ , and  $g$ , are given below. Use the functions to answer each of the following questions. If a value does not exist briefly explain why.

| $x$ | $h(x)$ |
|-----|--------|
| 0   | -5     |
| 1   | -2     |
| 2   | -1     |
| 3   | 6      |
| 4   | 9      |

$$f(x) = \frac{1}{x+1}$$

(a)

$$g(x) = \frac{1}{x} - 1$$
$$h\left(f\left(-\frac{1}{2}\right)\right)$$

\_\_\_\_\_

(b)

$$f(h(2))$$

\_\_\_\_\_

Show that  $f(g(x)) = x$ .

(c)

\_\_\_\_\_

6.

The equations for two different linear functions are the following:

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$$\text{Line 1 : } A(x) = 3x - 7,$$

$$\text{Line 2 : } B(x) = ax - 6,$$

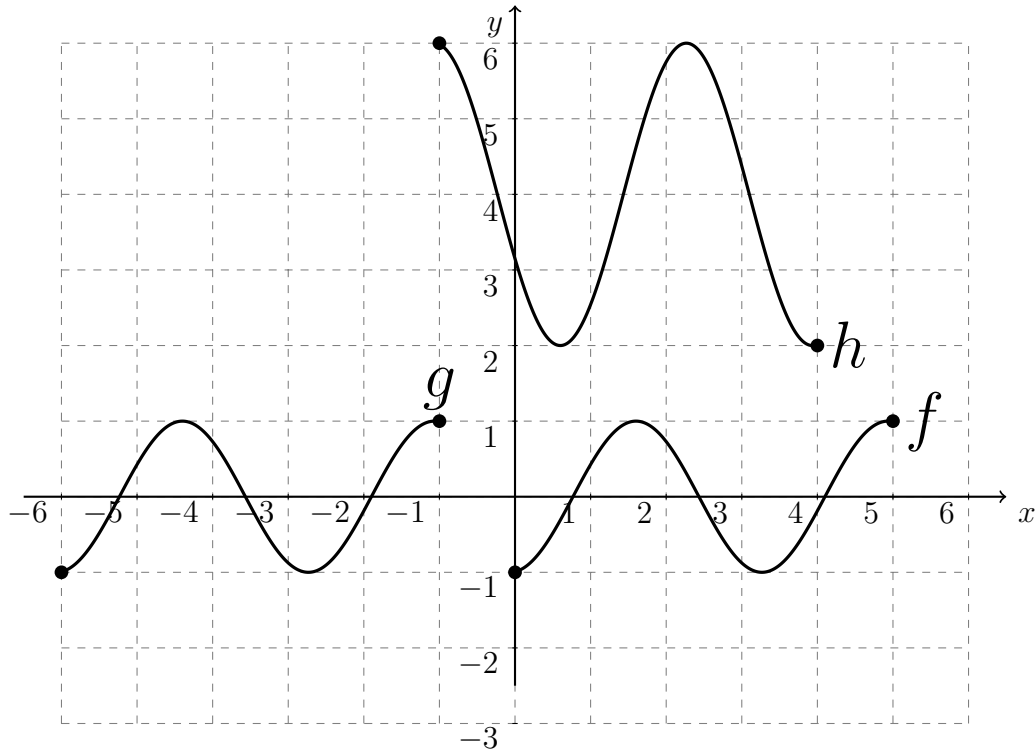
where  $a$  is a constant. Answer each question below and provide a brief justification for your answer.

(a) For what values of  $a$  does the function  $B(x)$  increase?

(b) For what values of  $a$  does the function  $B(x)$  decrease?

(c) For what values of  $a$  do the two lines intersect?

7. The graphs of two functions,  $f$  and  $h$ , are given in the plot below.



(a)

The function  $g$  can be written in terms of  $f$  as  $g(x) = Af(c \cdot x + d) + B$ . Determine the values of  $A$ ,  $B$ ,  $c$ , and  $d$ .

\_\_\_\_\_

(b)

The function  $h$  can be written in terms of  $f$  as  $h(x) = Af(c \cdot x + d) + B$ . Determine the values of  $A$ ,  $B$ ,  $c$ , and  $d$ .

\_\_\_\_\_

make a rough sketch of the function  $g(x) = f\left(\frac{1}{2}x + 3\right) - 2$ .

(c)

\_\_\_\_\_



8. A strain of bacteria is introduced into the gut of a rabbit. The density of bacteria is initially 15.5 bacteria per cubic centimeter. Initially the density increases and is a quadratic function. It hits a peak of 130.0 bacteria per cubic centimeter 18 hours later and then starts to decrease. After 21 hours the density of the bacteria stops changing and then remains constant afterward.

(a)

What is the density of the bacteria 24 hours after the bacteria is introduced?

\_\_\_\_\_

Express the density of the bacteria as a piecewise defined function.

(b)

\_\_\_\_\_

9.

A park will be constructed and will be in the shape of a rectangle. A sidewalk will be constructed around two edges of the park. The sidewalk will first go east and then turn directly south, and it will only enclose two sides of the rectangle. The cost for the part of the sidewalk going east is fifty dollars per foot. The cost for the part of the sidewalk going south is twenty dollars per foot. The total amount of money budgeted for the construction is \$10,000. What dimensions will result in the largest possible area for the park?

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: \_\_\_\_\_