PRINT YOUR NAME : _____

From the questions below, please choose and solve 10 problems only.
The homework is worth 10 points.
Show all of your work and put a box around your final answer.
Number each attempted question clearly.
Write legibly (that is, suitably large and suitably dark); if the grader can't read your answer, it's consider uncompleted.

Question 1 During the winter, a smart thermostat is set to adjust the temperature on a 24-hour cycle. It is programmed to reach a maximum of 71°F at 8PM, and a minimum of 65°F at 8AM. Let $T(t)$ be the thermostat setting t hours after midnight.

(a) Find a possible formula for $T(t)$.

(b) At what times throughout the day is the thermostat set to 69°F?

Question 2 Find *all* solutions of the following equations.

(a) $5\cos(2x+3) = \sin(2x+3)$

(b) $20 + 90\sin\left(3(t-2)\right) = 100$

(c) $\cos(6x-1) = \frac{4}{3}$

(d) $8\cos(5x) = 3$

Question 3 During a year, the length of a day, from sunrise to sunset, in Taloga, Oklahoma, varies from a shortest day of approximately 9.6 hours to a longest day of approximately 14.4 hours, while in Montreal, the day lengths vary from 8.3 hours to 15.7 hours. For each location, determine a function $L(t) = 12 + A\sin\left(\frac{2\pi}{365}\right)t$, that approximates the length of a day, in hours, where t represents the day in the year assuming t = 0 is the spring equinox on March 21. Compare the day lengths in each location on April 15, July 30, and November 15.

Question 4 A particular persons height oscillates throughout the day with a period of 24 hours. Their average height is 170 cm, and their maximum height is 173 cm. At 4 AM, their height is 170 cm and increasing.

(a) Find a possible formula for h(t), their height (in cm) t hours after midnight.

(b) Find a time when their height equals 169 cm.

Question 5 Sketch the graph $y = 2\sin\left(2\left(x - \frac{\pi}{2}\right)\right) - 1$ on $[0, 2pi]$. Calculate the amplitude, period, mid-line, maximum and minimum value, and the x-intercepts.

Question 6 Find each value.

(a) $\sin\left(\cos^{-1}\frac{1}{3}\right)$

(b) $\tan\left(\sin^{-1}\frac{3}{7}\right)$

(c) $\cos\left(\cot^{-1}\frac{5}{2}\right)$

Question 7 Sketch the graph of the following functions. State the domain and range for these functions.

(a) $y = \arcsin x$

(b) $y = \arccos x$

(c) $y = \arctan x$

Question 8 A ball dropped from a state of rest at time $t = 0$ travels a distance $s(t) = 4.9t^2$ m in t second.

(a) How far does the ball travel during the time interval $[2, 2.5]$?

(b) Compute the average velocity over $[2, 2.5]$?

(c) Compute the average velocity over $[2, 2.01]$?

(d) Compute the average velocity over $[2, 2.005]$?

(e) Compute the average velocity over $[2, 2.001]$?

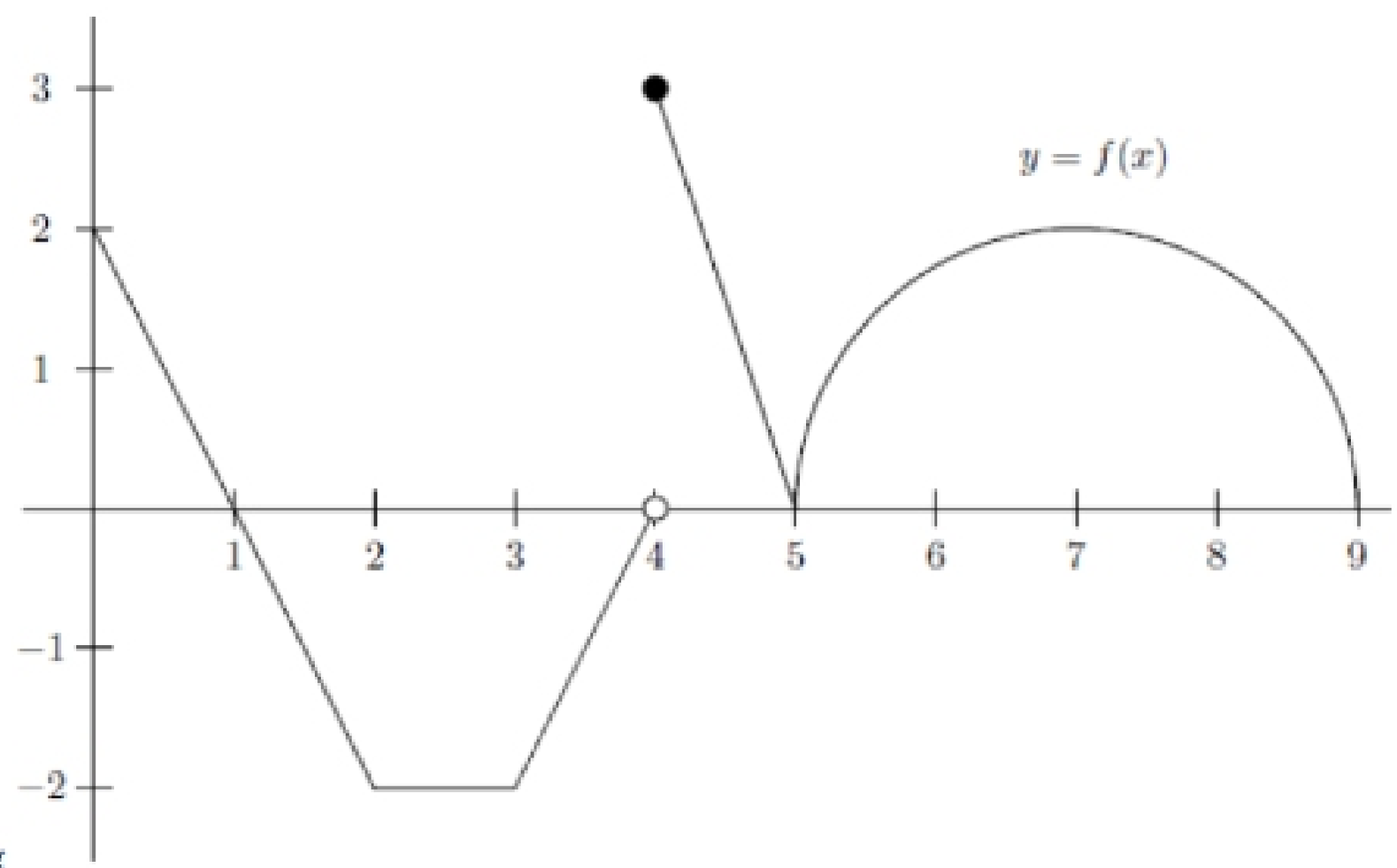
(f) Compute the average velocity over $[2, 2.0001]$?

(g) Estimate the instantaneous velocity over $t = 2$?

Question 9 Use the sketch of $y = (x)$ below to find

(a) the of instantaneous rate of change at $x = 7$.

(b) the average rate of change on $[0, 3]$



HW2Picture1.png

Question 10 Find an equation of the tangent line to the curve $y = x^3$ the point $(2, 8)$. Do not use derivative to calculate the slope of the tangent line.

Question 11 Draw a graph of a function $y = f(x)$ where the instantaneous velocity at $t = 2$ is very different from the average velocity between $t = 2$ and $t = 5$.

Question 12 Draw a graph of a function $y = f(x)$ so that the instantaneous velocity at $t = 2$ is the same as the average velocity between $t = 2$ and $t = 5$.