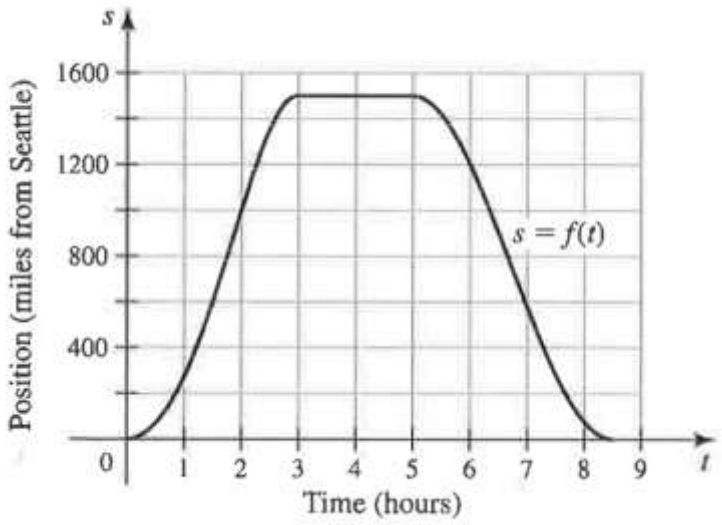
Name _____ Test 2, Fall 2018

1) Find the derivative of $f(x)$ below.
(4 points)

$f(x) = \sin(2x)$

2) Given the equation $x + y^2 = y$, find y'.
(6 points)

3) The graph below shows the position function of an airliner on an out-and-back trip from Seattle to Minneapolis where $s = f(t)$ is the number of round miles from Seattle t hours after take-off at 6am. When is the plane traveling the fastest toward Seattle?
(6 points)



4) Find the derivative of $f(x) = \tan(sin(cos(x)))$.
(4 points)

5) Given the equation $\sin(y) + \cos(x) = e^x$ where both x and y are functions t, find $\frac{dy}{dt}$.
(6 points)

6) Find the derivative of $\ln(x^7 + 2x)$.
(4 points)

7) Find the derivative of $\tan^{-1}(x^2 + 1)$.
(4 points)

8) Find the derivative of $\big((x + 2)(x^2 + 1)\big)^4$.
(6 points)

9) A certain cone starts out with a radius of 1mm and height of 3mm. It maintains the same aspect ratio while its radius expands at a rate of 4mm/s. When the volume is 27π mm^3, how quickly is the volume increasing?

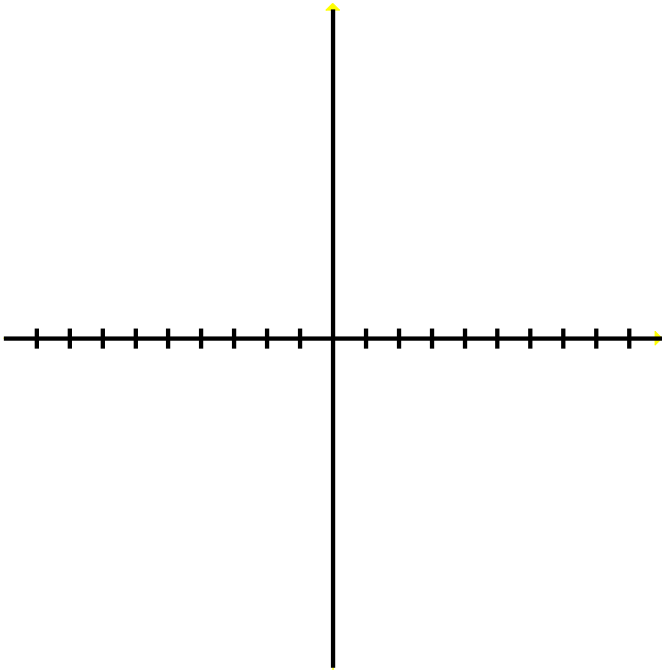
(Note that the volume of a right circular cone is given by $V = \frac{1}{3}\pi r^2 h$)

(10 points)

10) Use the first derivative test to graph the function below.

$$f(x) = x^3 + 3x^2 - 24x$$

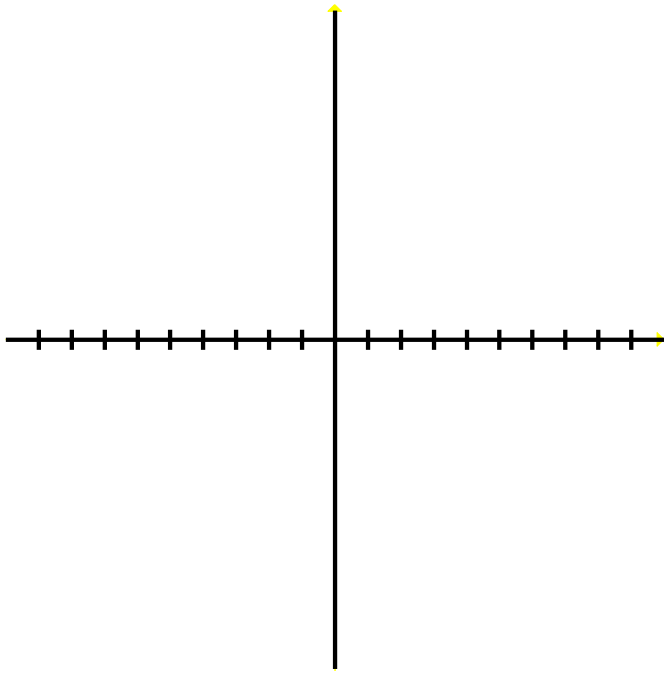
(10 points)



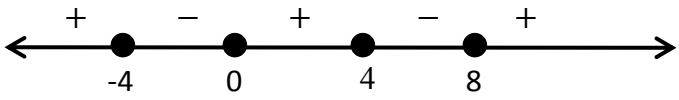
11) Use the second derivative test to graph the function below.

$$f(x) = 2x^3 - 6x^2 - 90x$$

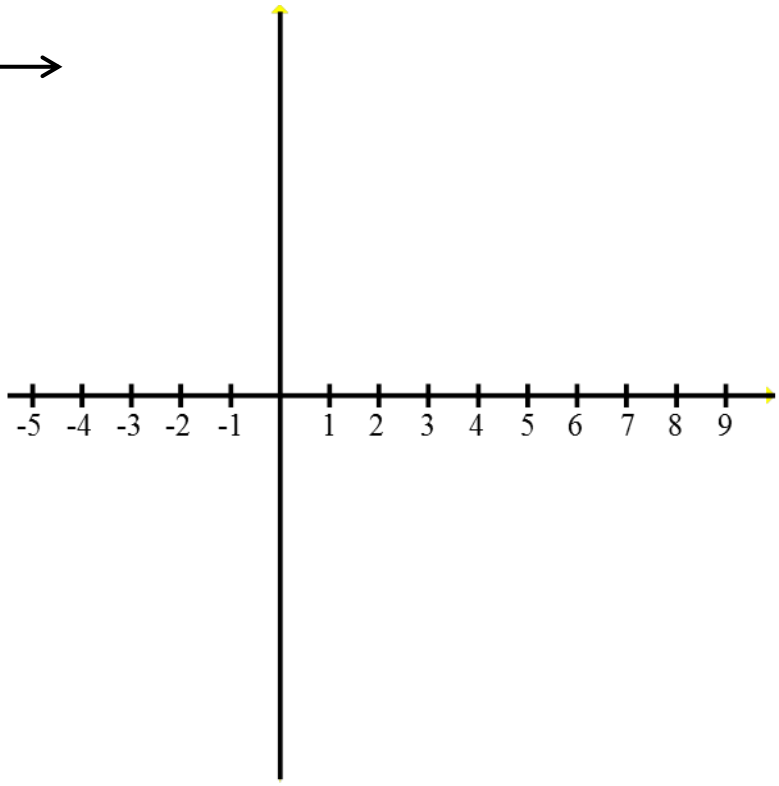
(10 points)



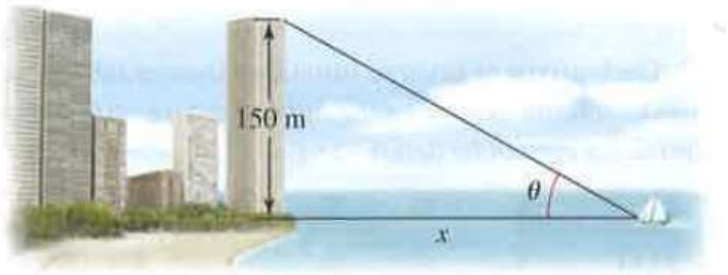
12) Graph a function f that is defined everywhere; the sign chart for $\frac{d}{dx}f$ is given below. Each value labelled on the sign chart is a critical value.

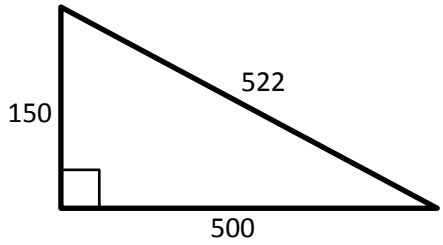


Assume we also know the following information:
$f(x)$ has inflection points at $x = -2, 2,$ and 5.
(10 points)



13) A boat sails directly toward a 150-meter skyscraper that stands on the edge of a harbor. The angular size θ of the building is the angle formed by lines from the top and bottom of the building to the observer (see figure). A particular triangle that might be helpful is also given.



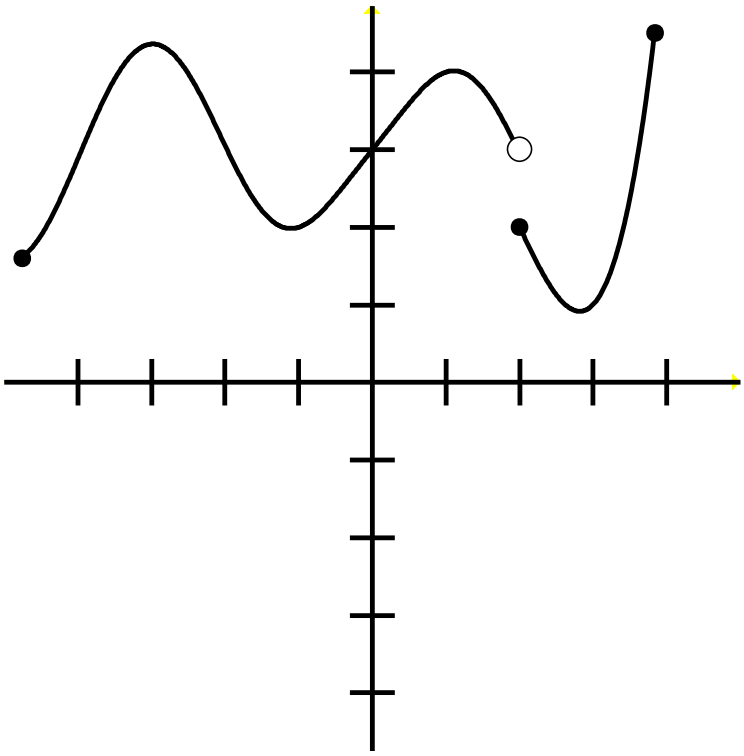


What is the rate of change of the angular size $\frac{d\theta}{dx}$ when the boat is $x = 500m$ from the building?

(10 points)

Use the graph below to answer the questions on this page.

14) Find all local maximizers of the function.
(4 points)



15) Find all local minimum values of the function.
(4 points)

16) Find all x-values where the function changes concavity.
(2 points)