Math 140
Summer 2018 Name:
Exam 3

1. $\boxed{\text{10 pts.}}$ Use the Closed Interval Method to find the absolute extreme values of

$$f(x) = \frac{4}{3}x^3 + 5x^2 - 6x$$

on $[-4, 1]$.

2. Let $f(x) = \dfrac{3x}{x^2 - 1}$.

   (a) $\boxed{\text{5 pts.}}$ Find the domain and intercepts of f.

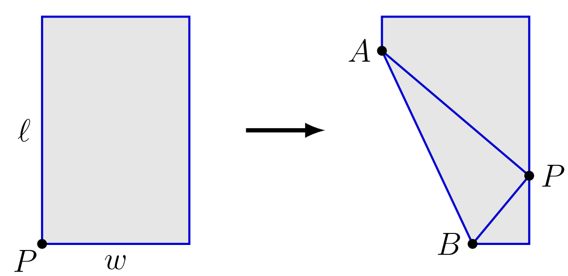
   (b) $\boxed{\text{5 pts.}}$ Find the asymptotes of f.

   (c) $\boxed{\text{5 pts.}}$ Find the critical points of f.

   (d) $\boxed{\text{10 pts.}}$ Use the Monotonicity Test to find intervals of increase and decrease, and use either the First Derivative Test or Second Derivative Test to find all local extrema.

   (e) $\boxed{\text{10 pts.}}$ Use the Concavity Test to find intervals where f is concave up or down, and identify inflection points.

3. $\boxed{\text{15 pts.}}$ A rectangular sheet of paper of width w and length ℓ, where $0 < w < \ell$, is folded by taking one corner of the sheet and placing it at a point P on the opposite long side of the sheet. The fold is then flattened to form a straight crease across the sheet. Assuming that the fold is made so that there is no flap extending beyond the edge of the sheet, find the point P that produces the crease of minimum length. What is the length of that crease? (The crease is the segment from A to B in the figure below.)



4. $\boxed{\text{10 pts.}}$ Use linear approximation to approximate the change in the lateral surface area S (excluding the area of the base) of a right circular cone with fixed height $h = 6$ m when its radius decreases from $r = 10$ m to $r = 9.9$ m. In general $S = \pi r\sqrt{r^2 + h^2}$.

5. $\boxed{\text{10 pts.}}$ Suppose f is continuous on $[-2, 14]$ and differentiable on $(-2, 14)$. Also suppose that $f(14) = 7$ and $f'(x) \leq 10$ for all $x \in (-2, 14)$. What is the smallest possible value for $f(-2)$?

6. $\boxed{\text{10 pts. each}}$ Use L'Hôpital's Rule to evaluate each limit.

(a) $\displaystyle\lim_{x\to 0} \frac{\sin^2 3x}{x^2}$.

(b) $\displaystyle\lim_{x\to \pi/2} \frac{2\tan x}{\sec^2 x}$.

7. $\boxed{\text{10 pts. each}}$ Determine the following indefinite integrals.

(a) $\displaystyle\int \left(\frac{7}{t^4} + 8\sqrt{t}\right) dt$.

(b) $\displaystyle\int (5z^4 - 16\sec^2 2z)\, dz$.