Instructor: Dr. R.A.G. Seely
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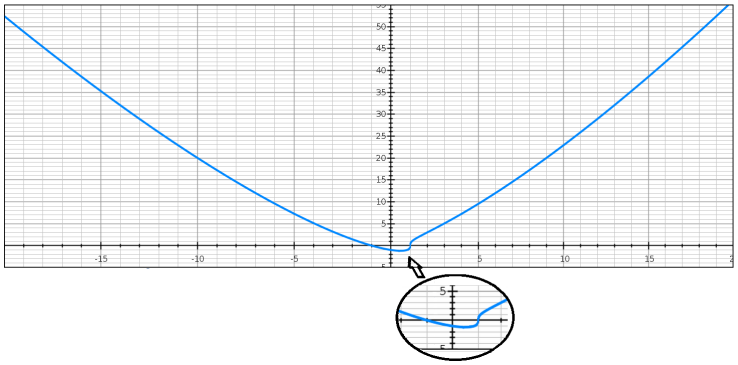
Test 3
(Version A)

Cal I (S) (Maths 201–NYA)

Answers

1. $y' = \dfrac{2x + 5x^2}{\sqrt{1+2x}}$ $\quad y'' = \dfrac{15x^2 + 12x + 2}{(1+2x)^{3/2}}$

2. Domain: all x
   No VA, no HA; intercepts: $x = \pm 1$, $y = -1$
   CP at $x = \frac{1}{2}, 1$; PI at $x = 1, 2$.
   (vertical tangent at $x = 1$)
   Dec: $(-\infty, \frac{1}{2})$; Inc: $(\frac{1}{2}, \infty)$
   local (and global) min at $x = \frac{1}{2}$
   (where $y = -\frac{3}{2\sqrt[3]{2}} \cong -1.2$)
   $\bigcup$: $(-\infty, 1), (2, \infty)$; $\quad \bigcap$: $(1, 2)$
   Graph at far right (region around the origin enlarged):
   (See version B for a similar graph
   with a different "emphasis".)



3. $f'(x) = -1/x^2$ is never $= 1$. But f is not differentiable (nor continuous) on $(-1, 1)$ since it has a vertical asymptote at $x = 0$, so does not satisfy the hypotheses of the MVT.

4. Cut out 1 cm squares from the corners, so the dimensions of the box are 4cm by 4cm by 1cm.

5. $f(x) = \frac{1}{2}x^3 - 2\cos(x) + \frac{1}{2}x^2 + x + 6$

6. $(\frac{1}{2} \cdot 2^{2/2} + \frac{2}{2} \cdot 2^{4/2} + \frac{3}{2} \cdot 2^{6/2} + \frac{4}{2} \cdot 2^{8/2})\frac{1}{2} = 49/2$

7. (a) $-x^{-3} - 5\ln|x| - \frac{3}{4}x^{-8/3} + C$ $\qquad$ (b) $\pi^2 x + \frac{6}{7}x^{7/6} - \mathrm{e}^x + C$
   (c) $\tan t - \sec t]_0^{\pi/4} = 2 - \sqrt{2}$
   (d) 4 (Two triangles ($b = h = 2$) each with area $= 2$)
   (e) 0

8. $\dfrac{2x^3}{1 + \mathrm{e}^{x^2}}$

9. $\displaystyle\int_0^{\pi} \sin x \, dx = 2$