Answer Key

Part A

1a. $f'(t) = -4\cos(2t-\pi)\left[\sin(2t-\pi)\right]$ 1b. $g'(x) = \left(\frac{3x-2}{2x}\right)\left(\frac{(3x-2)(2)-(2x)(3)}{(3x-2)^2}\right) = \frac{-2}{x(3x-2)}$

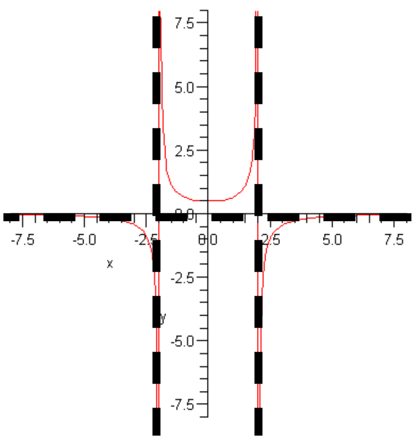
1c. $h'(t) = 8t^2\cos(2t) + 8t\sin(2t)$ 1d. $f'(x) = \frac{1}{(1+2x)\sqrt{2x}}$ 1e. I = $\sin(x) + x^3 + x \;\Big|_0^1 = \sin(1) + 2$

2a. ∞ 2b. 1 2c. $1/3$

3a. vertical asymptotes at $x = \pm 2$ 3b. horizontal asymptote at y = 0

3c. $f'(x) = \frac{4x}{\left(4-x^2\right)^2} = 0 \Rightarrow x = 0;\; f''(x) = \frac{12x^2+16}{(4-x^2)^3};\; f''(0) = .25 > 0 \Rightarrow \textit{local}$ min

3d.



Part B

1	a		**6**	d		**11**	b		**16**	a
2	X none		**7**	c		**12**	c		**17**	c
3	d		**8**	b		**13**	b		**18**	b
4	d		**9**	d		**14**	a		**19**	b
5	c		**10**	a		**15**	a		**20**	c

Part C

1a. $f'(x) = \lim_{h\to 0}\frac{3(x+h)^2 + 2(x+h) - 1 - \left[3x^2 + 2x - 1\right]}{h} = \ldots 6x + 2$ 1b. $y = 8x - 4$

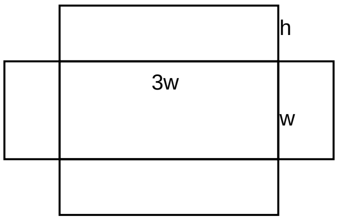
1c. f is increasing at Q since $f'(Q) = 8 > 0$

2. $v = \pi r^2 h \Rightarrow \frac{dv}{dt} = \pi\left[r^2\frac{dh}{dt} + h(2r)\frac{dr}{dt}\right] = \pi\left[.2^2(3) + 10(2)(.2)(.1)\right] = .52\pi = 1.63\; ft^3$

3. $s(t)=t^3+\frac{t^2}{2}+t-11$

4. $g'(x)=6x(x^2-1)^2=0 \Rightarrow critical\ \#s\ \ at\ \ x=0,-1,1$
$g(1)=g(-1)=0$; $g(0)=-1 \leftarrow \{abs.\min.\}$; $g(2)=27 \leftarrow \{abs.\max.\}$

5.



Objective: Minimize surface area subject to volume constraint

$v=lwh=3w^2h=9 \quad \Rightarrow h=\frac{3}{w^2}$

$A_s=3w^2+2(3w)h+2wh=3w^2+\frac{24}{w} \quad A_s'=6w-\frac{24}{w^2}=0$

$\therefore w=1.59\,ft. \quad l=4.76\,ft. \quad h=1.19\,ft.$

6a. $v(t)=3t^2-12t+9$ 6b. stopped when v(t)=0: t=1 and t=3 sec 6c. s(5)-s(0) =20-0=20 cm

6d. total distance = $|s(1)-s(0)|+|s(3)-s(1)|+|s(5)-s(3)|=4+4+20=28\,\text{cm}$

7a. using implicit differentiation: $y'=\frac{-3y-2xy-2}{x^2+3x-1}$

7b. using logarithmic differentiation: $y'=2x^{\sin x}\left[\frac{\sin x}{x}+(\ln x)(\cos x)\right]$