MATH 1210 2.1

②

t (Min)	36	38	40	42	44
Heartbeats	2530	2661	2806	2948	3080

Beats/Min

m_{SEC} = a) $\frac{2948-2530}{42-36} = 69.\overline{6}$ b) $\frac{2948-2661}{42-38} = 71.75$ c) $\frac{2948-2806}{42-40} = 71.0$ d) $\frac{3080-2948}{44-42} = 66.0$

CONCLUSIONS: IF our goal is to estimate the INSTANTANEOUS Heart Rate at $t = 42$ min, c & d would be the best approximators because they have the smallest Δt.

Best yet, average those two: INSTANTANEOUS Heart Rate = $m_{TAN} \approx \frac{71+66}{2} = 68.5$ Beats/Min at $t=42$

⑥ $y = 10t - 1.86t^2$ Position of a Rock thrown Upwards on Mars

seconds t	1	2	1.5	1.1	1.01	1.001
meters y	8.14	12.56	10.815	8.7494	8.202614	8.14627814

a) $v_{AVE} = m_{sec}$ = i) $\frac{12.56-8.14}{2-1} = 4.42$ ii) $\frac{10.815-8.14}{1.5-1} = 5.35$ iii) (1 to 1.1) 6.094 iv) (1 to 1.01) 6.2614 v) (1 to 1.001) 6.27814 m/s

b) To estimate m_{TAN} ($v_{INSTANTANEOUS}$) the best answer from a is the one with the smallest Δt. Therefore $v_{INST} \approx$ 6.28 m/s at $t=1$

⑧ This problem is almost identical to ⑥, except they use $s(t)$ instead of $y(t)$.

$s = 2\sin(\pi t) + 3\cos(\pi t)$

seconds t	1	2	1.1	1.01	1.001
cm s	-3	3	-3.4712	-3.06134	-3.006268

a) $v_{AVE} = m_{SEC}$ = i) (1 to 2) 6 ii) (1 to 1.1) -4.712 iii) (1 to 1.01) -6.13412 iv) (1 to 1.001) $\frac{-3.006268-(-3)}{1.001-1} \approx -6.26837$

b) $v_{INST} = m_{TAN} = \lim_{t \to 1} [m_{SEC}]$ ($\Delta t \to 0$) The best approximator in (a) is answer (iv)

Compare -6.268 to $-2\pi \approx -6.283$

you may conclude $v_{INST} = -2\pi \frac{cm}{s}$ at $t=1$