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I Don't Wanna Be Chicken Worksheet Answer Key

Fracture Data Analysis of 3-Point Bending on a Chicken Bone

1. Look at the data table and find the Young's Modulus given for your data set keeping in mind the average age of a chicken at slaughter is 6 weeks.
   Six-week old chicken YM = A: 377,000,000 Pa; B: 434,000,000 Pa; C: 363,000,000 Pa
   How does this value compare to the Young's Modulus of a two-month old female mouse from the following scholarly article: Two-month old mouse YM = 7,400,000,000 Pa
   http://www.musculoskeletalcore.wustl.edu/mm/files/Understanding%203pt%20Bending%20outcomes.pdf
   Does this make sense? Explain why or why not?
   The data shows that the mouse has stiffer bones than the chicken. One reason could be that the mouse as a species has stiffer bones. Another might be that the average lifespan of a mouse is less than two years in the wild whereas a backyard chicken might live for six to eight years. The chicken at six weeks is still immature.

2. How does the Young's Modulus in this activity compare with the Young's Modulus of a 20-month old female mouse from the article referenced in the previous question?
   Twenty-month old mouse YM = 5,600,000,000 Pa
   Note that in the wild, mice tend to live only five or six months; however, in ideal indoor conditions they can live up to two years. Does this make sense? Explain.
   A twenty-month mouse would be considered old. Hence, its bone stiffness has softened over time. It is interesting to note that it is still stronger than the juvenile chicken from the previous question.

3. Use Desmos to run a higher-order polynomial regression on the second data set representing the ductile region. You will have to experiment with regression functions to determine if the function is best modeled by a quadratic, cubic, or quartic. Notice the R^2 value; however, if the value does not change much, there is no point in adding complexity using a higher-ordered function. Which model did you choose?
   A: quadratic; B: cubic; C: cubic

4. Write the deformation region's best-fit polynomial along with the restricted domain, using interval notation. Note: Since the domain starts with where you left off the linear restriction, one should be closed and the other open in the interval notation. (You may have to use closed notation in Desmos in order for the graph to show.)
   A: $-51{,}905{,}000x^2 + 367{,}976x - 325{,}446,\ (.00275,\ .0045]$
   B: $-3{,}973{,}000{,}000x^3 - 7{,}517{,}800x^2 + 197{,}751x + 57{,}9622,\ (.0017,\ .0045]$
   C: $2{,}859{,}400{,}000x^3 - 34{,}909{,}000x^2 + 128{,}213x + 95.8182,\ (.002,\ .0045]$

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5. Write a complete piece-wise defined function for the entire data set:

A: $\begin{cases} y = 120{,}271x - 30.2037, & 0 \le x \le .00275 \\ -51{,}905{,}000x^2 + 367{,}976x - 325{,}446, & .00275 < x \le .0045 \end{cases}$

B: $\begin{cases} y = 148{,}153x - 32.1568, & 0 \le x \le .0017 \\ -3{,}973{,}000{,}000x^3 - 7{,}517{,}800x^2 + 197{,}751x + 57{,}9622, & .0017 < x \le .0045 \end{cases}$

C: $\begin{cases} y = 134{,}521x - 20.9957, & 0 \le x \le .002 \\ 2{,}859{,}400{,}000x^3 - 34{,}909{,}000x^2 + 128{,}213x + 95.8182, & .002 < x \le .0045 \end{cases}$

linear

ductile

Sample A		Sample B		Sample C	
Displacement (m)	Force (N)	Displacement (m)	Force (N)	Displacement (m)	Force (N)
0	0	0	0	0	0
.00025	5	.00025	5	.00025	5
.0005	10	.0005	20	.0005	20
.00075	40	.00075	70	.00075	70
.001	75	.001	85	.001	120
.0012	110	.0012	145	.0012	160
`.0015	150	.0015	200	.0015	180
.00175	185	.00175 **YIELD**	240	.00175	220
.0020	220	.0020	265	.0020 **YIELD**	240
.00225	245	.00225	310	.00225	235
.0025	275	.0025	330	.0025	237
.00275 **YIELD**	295	.00275	350	.00275	245
.003	310	.003	360	.003	252
.00325	320	.00325	365	.00325	244
.0035	330	.0035	370	.0035	237
.00375	325	.00375	362	.00375	233
.004	315	.004	360	.004	232
.00425	300	.00425	355	.00425	231
.0045 **FRACTURE**	280	.0045 **FRACTURE**	350	.0045 **FRACTURE**	227
Young's Modulus		**Young's Modulus**		**Young's Modulus**	
3.77E+08 N/m^2		4.34E+08 N/m^2		3.63+08 N/m^2	

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Specimen A	
Displacement (m)	**Force (N)**
0	0
.00025	5
.0005	10
.00075	40
.001	75
.0012	110
.0015	150
.00175	185
.0020	220
.00225	245
.0025	275
.00275	295
.003	310
.00325	320
.0035	330
.00375	325
.004	315
.00425	300
.0045	280
Young's Modulus	
3.77E+08 N/m^2	

Name: ___________________________________ **Date:** _______________ **Class:** _______________

Specimen B	
Displacement (m)	**Force (N)**
0	0
.00025	5
.0005	20
.00075	70
.001	85
.0012	145
.0015	200
.00175	240
.0020	265
.00225	310
.0025	330
.00275	350
.003	360
.00325	365
.0035	370
.00375	362
.004	360
.00425	355
.0045	350
Young's Modulus	
4.34E+08 N/m^2	

Name: ___________________________ **Date:** _____________ **Class:** _____________

Specimen C	
Displacement (m)	**Force (N)**
0	0
.00025	5
.0005	20
.00075	70
.001	120
.0012	160
.0015	180
.00175	220
.0020	240
.00225	235
.0025	237
.00275	245
.003	252
.00325	244
.0035	237
.00375	233
.004	232
.00425	231
.0045	227
Young's Modulus	
3.63+08 N/m^2	