Here are some problems from Prof. Harrell's tests given last year, for practice for this week. Because of differences in the calendar, PRoblems 3-4 are from the first test from last year, and problem 1 from the second.

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In problems 1 and 2 we shall amuse ourselves with three vectors,

$\mathbf{u} = (2,2,2)$
$\mathbf{v} = (1,0,-1)$
$\mathbf{w} = (1,5,1)$

1. (10 points) Calculate the lengths of these vectors and the cosines of the angles between them. consider all possibilities.

ANSWERS:

$|\mathbf{u}|$ = _____
$|\mathbf{v}|$ = _____
$|\mathbf{w}|$ = _____

COSINES OF ANGLES: Fill in the table with the cosines of the angles of the vectors of the given column and row.

| | **u** | **v** | **w** |
|---|---|---|---|
| **u** | | | |
| **v** | | | |
| **w** | | | |

KEY FORMULA OR METHOD (optional for partial credit)_____
_____

**(Problem 2 deleted)**

**Problems 3 and 4 are concerned with estimating the integral $\frac{3}{1+4x^2}$. No credit will be given for an accurate estimate of this integral, only for the approximation.**

**3**. (10 points) In this problem we use Taylor's polynomial and series.

a) Find the Taylor polynomial in powers of x up to and including $x^4$ for $\frac{3}{1+4x^2}$.

$p_4(x)$ = _____+_____ x + _____ $x^2$ + _____ $x^3$ + _____ $x^4$

b) Evaluate the integral $\int_0^{1/2} p_4(x)\,dx$.

$\int_0^{1/2} p_4(x)\,dx$ = _____

c) For what positive values of x is the Taylor series convergent for $\int_0^x \frac{3}{1+4t^2}\,dt$ ?

ANSWER: It converges for exactly the following values of x:_____.

KEY FORMULA OR METHOD (optional for partial credit)_____
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**4**. (10 points)

a) Evaluate the integral $\int_0^{1/2} \frac{3}{1+4x^2}\,dx$ with the trapezoid rule, n=4:

$\int_0^{1/2} \frac{3}{1+4x^2}\,dx \doteq$ _____

b) Evaluate the integral $\int_0^{1/2} \frac{3}{1+4x^2}\,dx$ with Simpson's rule, n=**2**:

$\int_0^{1/2} \frac{3}{1+4x^2}\,dx \doteq$ _____

KEY FORMULA OR METHOD (optional for partial credit)_____