100	90's	80's	70's	60's	< 60
0	4	3	5	5	5

Assessment 3
Dusty Wilson
Math 254

mean 73.4%
median 72.1%

No work = no credit
No CAS Calculators

Name: key

Whenever an infinite series is obtained as the development of some closed expression [formula for a function], *it may be used in mathematical operations as the equivalent of that expression, even for values of the variable for which the series diverges.*

Leonhard Euler
1707 – 1783 (Swiss Mathematician)

Warm-ups (1 pt each): $\frac{\partial}{\partial y} x\ln(y) = \frac{x}{y}$ $\quad \iint_D 0\, dA = 0$ $\quad \frac{\partial}{\partial x}\tan^{-1}(xy) = \frac{y}{1+(xy)^2}$

1.) (1 pt) The quote by Euler (above) is from our reading for this week. According to Euler, when was it acceptable to use divergent series? Answer using complete English sentences.

We can use divergent series when we find them as a result of obtaining a formula for a function.

2.) (10 pts) Consider $f(x,y) = x^2 + x\sin(y)$ at the point $(2, 0)$. Find and interpret the directional derivative in the direction of $\vec{a} = \langle 3,4\rangle$.

$$\nabla f = \langle 2x + \sin y,\ x\cos(y)\rangle \Big|_{(2,0)} \langle 4, 2\rangle$$

$$\vec{u} = \langle \tfrac{3}{5}, \tfrac{4}{5}\rangle$$

$$D_{\vec{u}} f = \langle \tfrac{3}{5}, \tfrac{4}{5}\rangle \cdot \langle 4, 2\rangle = 4$$

The slope of f @ the point (2,0) in the direction ⟨3,4⟩ is 4.

3.) (10 pts) Evaluate the double integral $I = \iint_R x e^{xy}\, dA$ where $R = [0,1]\times[0,2]$.

$$I = \int_0^1 \int_0^2 x e^{xy}\, dy\, dx$$

$$= \int_0^1 \left[e^{xy} \right]_{y=0}^{y=2} dx$$

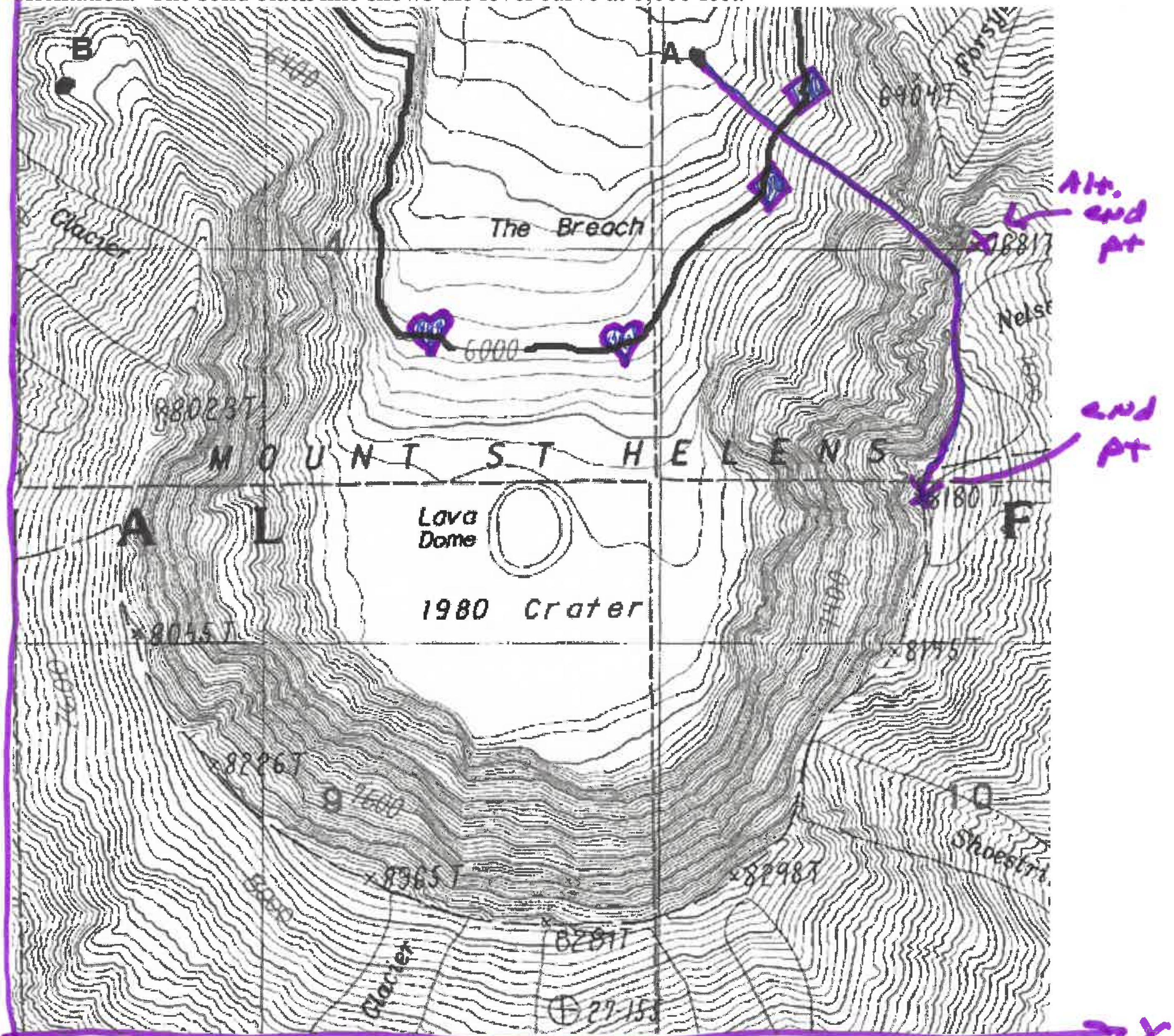
$$= \int_0^1 e^{2x} - 1\ dx$$

$$= \left[\tfrac{1}{2} e^{2x} - x \right]_0^1$$

$$= \left(\tfrac{e^2}{2} - 1\right) - \left(\tfrac{1}{2} - 0\right)$$

$$= \tfrac{1}{2}(e^2 - 3)$$

4.) (6 pts) Consider the contour plot (topographical map) of the crater of Mt Saint Helens where $z = f(x, y)$ gives the altitude (in feet) at point (x, y) where x and y have the traditional orientation. The solid black line shows the level curve at 6,000 feet.



a.) On the contour plot, clearly mark with a diamond ♦ the point(s) of the level curve $f(x, y) = 6{,}000$ at which $f_x > 0$ and $f_y = 0$.

b.) On the contour plot, clearly mark with a heart ♥ the point(s) of the level curve $f(x, y) = 6{,}000$ at which the slope is shallowest ($|\nabla f|$ is small).

c.) Beginning at point A, clearly sketch the path of steepest ascent.