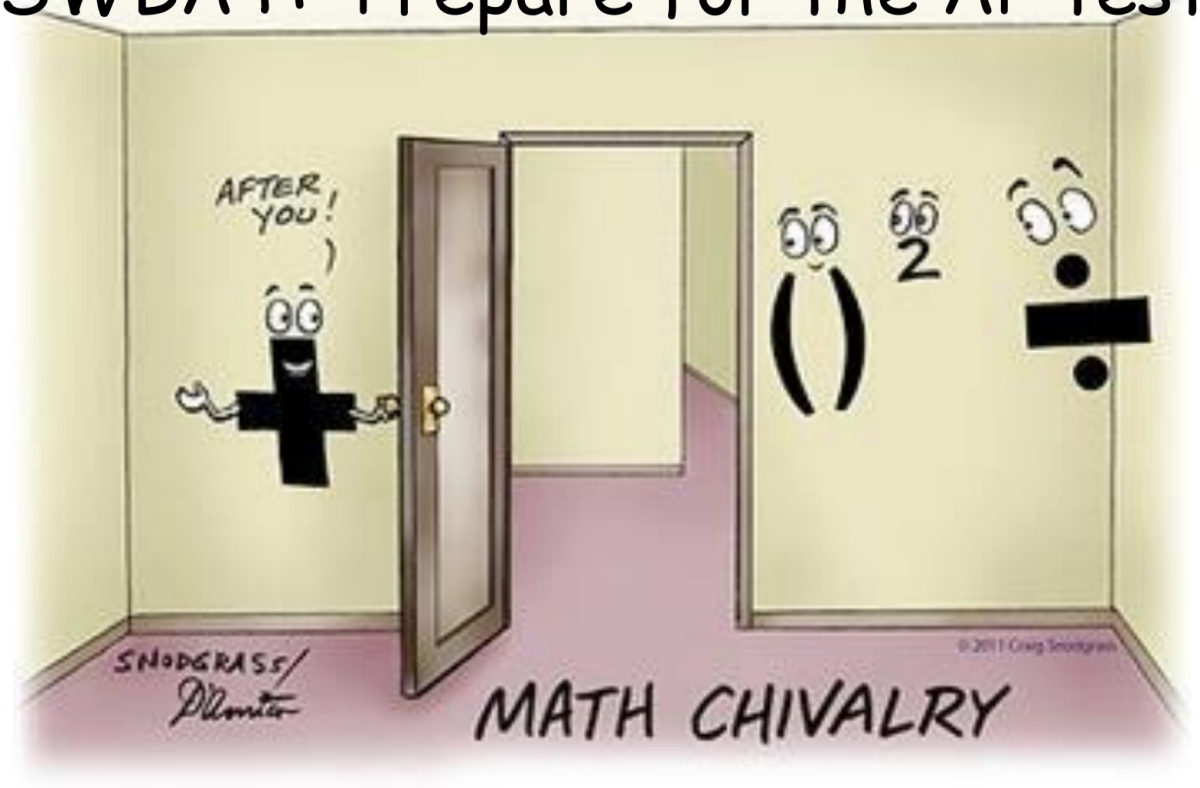
SWBAT: Prepare for the AP test



Exam Tips: Calculus

Show all work.
Remember that the grader is not really interested in finding out the answer to the problem. The grader is interested in seeing if you know how to solve the problem.

Do not round partial answers.
Store them in your calculator so that you can use them unrounded in further calculations.

Do not let the points at the beginning keep you from getting the points at the end.
If you can do part (c) without doing (a) and (b), do it. If you need to import an answer from part (a), make a credible attempt at part (a) so that you can import the (possibly wrong) answer and get your part (c) points.

If you use your calculator to solve an equation, write the equation first.
An answer without an equation might not get full credit, even if it is correct.

If you use your calculator to find a definite integral, write the integral first.
An answer without an integral will not get full credit, even if it is correct.

Do not waste time erasing bad solutions.
If you change your mind, simply cross out the bad solution after you have written the good one. *Crossed-out work will not be graded.* If you have no better solution, leave the old one there. It might be worth a point or two.

Do not use your calculator for anything except:
(a) graph functions, (b) compute numerical derivatives, (c) compute definite integrals, and (d) solve equations. In particular, do not use it to determine max/min points, concavity, inflection points, increasing/decreasing, domain, and range. (You can explore all these with your calculator, but your solution must stand alone.)

Be sure you have answered the problem.
For example, if it asks for the maximum value of a function, do not stop after finding the x at which the maximum value occurs. Be sure to express your answer in correct units if units are given.

If you can eliminate some incorrect answers in the multiple-choice section, it is advantageous to guess.
Otherwise it is not. Wrong answers can often be eliminated by estimation, or by thinking graphically.

If they ask you to justify your answer, think about what needs justification.
They are asking you to say more. If you can figure out why, your chances are better of telling them what they want to hear. For example, if they ask you to justify a point of inflection, they are looking to see if you realize that a sign change of the second derivative must occur.

Top Ten Student Errors

1. $f''(x) = 0 \Leftrightarrow (x, f(x))$ is a point of inflection.

f'' needs to change sign too

$f''(x)$ can be undefined

2. $f(x)$ is a maximum (minimum) $\Leftrightarrow f'(x) = 0$

$f'(x)$ can be undefined

3. Average rate of change of f on [a, b] is $\dfrac{f'(a) + f'(b)}{2}$

$\dfrac{f(b)-f(a)}{b-a}$ = ave rate of change

$\dfrac{\int_a^b f(x)\,dx}{b-a}$ = ave valu

4. Volume by ~~washers~~ disk method is $\int_a^b \pi(R-r)^2\,dx$

$\pi\int_a^b (OR)^2 - (IR)^2\,dx$

5. Separable differential equations can be solved without separating the variables.

"find the particular solution"

6. Omitting the constant of integration, especially in initial value problems.

7. Graders will assume the correct antecedents for all pronouns used in justifications.

8. If the correct answer came from your calculator, the grader will assume your setup was correct.

9. Universal logarithmic antidifferentiation: $\displaystyle\int \frac{1}{f(x)}\,dx = \ln|f(x)| + C.$

10. $\dfrac{d}{dx} f(y) = f'(y)$ and other Chain Rule errors.

- Vectors may be written using parentheses, ( ), or pointed brackets, ⟨⟩, or even $\vec{i}, \vec{j}$ form. The pointed brackets seem to be the most popular right now, but any notation is allowed.
- Find the speed at time t: $\text{Speed } = \sqrt{(x'(t))^2 + (y'(t))^2}$
- Use the definite integral for arc length to find the distance traveled $\int_a^b \sqrt{(x'(t))^2 + (y'(t))^2}dt$. Notice that this is the integral of the speed (rate times time = distance).
- The slope of the path is $\frac{dy}{dx} = \frac{y'(t)}{x'(t)}$.
- Determine when the particle is moving left or right, $y'(t) = 0$.
- Determine when the particle is moving up or down $x'(t) = 0$.
- Find the extreme position (farthest left, right, up or down).
- Given the position find the velocity by differentiating; given the velocity find the acceleration by differentiating.
- Given the acceleration and the velocity at some point find the velocity by integrating; given the velocity and the position at some point find the position by integrating. These are really just initial value differential equation problems (IVP).

What students should know how to do

- Find the intersection of two graphs (to use as limits of integration).
- Find the area enclosed by a graph or graphs using the formula $A = \frac{1}{2}\int_{\theta_1}^{\theta_2} (r(\theta))^2 d\theta$
- Use the formulas $x(\theta) = r(\theta)\cos(\theta)$ and $y(\theta) = r(\theta)\sin(\theta)$ to
  - convert from polar to rectangular form,
  - calculate the coordinates of a point on the graph, and
  - calculate $\frac{dy}{d\theta}$ and $\frac{dx}{d\theta}$ (Hint: use the product rule).
  - Discuss the motion of a particle moving on the graph by discussing the meaning of $\frac{dr}{d\theta}$ (motion towards or away from the pole), $\frac{dy}{d\theta}$ (motion in the vertical direction) or $\frac{dx}{d\theta}$ (motion in the horizontal direction).
  - Find the slope at a point on the graph, $\frac{dy}{dx} = \frac{dy/d\theta}{dx/d\theta}$.