Misc

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Problem Solving Matters

General Tips

- Be lazy; only do necessary work
- Write in sentences to explain (especially in proofs)
- Avoid long and/or complicated calculations
- Draw diagrams and make them big
- In diagrams, label things and add lines
- Look for similar shapes (often triangles)

Tips For Sketching Graphs

- Look for symmetries
- Think about periodicity
- Look for turning points (0 derivative)
- Look for asymptotes
- Try values of x like 0, 1, -1, etc.
- If there's a trig function involved, try multiples of π
- See what happens when x tends to 0 or $\pm\infty$

Things To Remember

- $\log_a b \times \log_b a = 1$
- $\log_{a^c} b^c = \log_a b$
- When graphing $y^2 = f(x)$, draw the positive branch of $y = \sqrt{f(x)}$ *and* reflect it in the x axis
- $\log x$ is negative when $0 < x < 1$

STEP Tips

General

- Be very careful with the stem; it will be used for the rest of the question
- Explore the stem to get everything out of it that you can
- Check every line of algebra when you write it
- Don't take shortcuts unless you can justify ***why*** they're allowed

Calculus

- If you can get an integral I in two forms, try adding them
- If given a substitution and asked to find a similar one for a slightly different function, find what made the first substitution work. What cancelled?
- To differentiate an equation of the form $y = f(x)^{g(x)}$, take logs and differentiate $\ln y = g(x)\ln\big(f(x)\big)$ implicitly

Trig

- If you've got multiple trig terms on the top of a fraction and just one on the bottom, try using tan
- If you have a sum of products of n trig terms like $\cos^2 x + \cos x \sin x$ $(n = 2)$, then you can divide by $\cos^n x$ (in this example, you get $1 + \tan x$)

Proof

- A powerful form of proof is to try some simple cases, make a conjecture, and prove it to be true by induction

Specifics

- Be careful when cancelling fractions with a factorial on the bottom $\left(\dfrac{x^2}{x!} = \dfrac{x}{(x-1)!} \neq \dfrac{1}{(x-2)!}\right)$