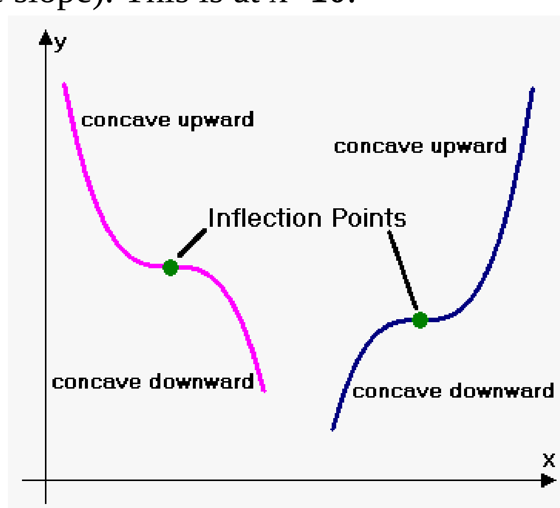
1. There are two areas to solve for: the triangle and the quarter circle. The area of the triangle can be found by: (0.5)bh. (0.5)(1)(1) = 0.5 (Each of the lengths for the base and height can be found on the graph.) The area of the quarter circle is (1/4)(pi)(r^2)=(1/4)(pi)(1^2)=pi/4. The sum is $\boldsymbol{\frac{2+\pi}{4}}$
2. A relative minimum can be found when the derivative goes from a negative to a positive value. That occurs at the value of x = **4**.
3. Average rate of change is just the slope between the two coordinate pairs: (2,7) and (5,2.5). m = **-1.5**
4. Average value of a function: $\frac{1}{b-a}\int_a^b f(x)dx$

$$\frac{1}{2}\int_0^2 f(x)dx = 0.4\,;\ \int_0^2 f(x)dx = 0.8\,;\quad -\int_0^2 f(x)dx = -0.8 = \int_2^0 f(x)dx = \mathbf{-0.8}$$

5. $xlnx - x|_1^{e^3} = e^3(lne^3) - e^3 - (1\ln(1) - 1) = \mathbf{2e^3 + 1}$
6. $\frac{3x-4}{(x-3)(x+2)} = \frac{1}{x-3} + \frac{2}{x+2}\ ;\ \int \frac{dx}{x-3} + 2\int \frac{dx}{x+2} = ln|(x-3)(x+2)^2| + c;$ $\boldsymbol{f(x) = (x-3)(x+2)^2}$
7. A relative maximum comes when the derivative changes from an increasing (positive slope) to decreasing (negative slope). This is at x=**10**.
8. Points of inflection are where concavity changes signs, this is at **b and g**.



9. By direct substitution, I get 0/0 which is one of the indeterminate forms. So I use L'Hospital's: $\lim_{\theta\to 0}\frac{2\theta+2}{2cos(2\theta)} = \frac{2}{2} = \mathbf{1}$
10. $By\ definition$: $\tan^{-1}(x)|_1^{\sqrt{3}} = \frac{\pi}{3} - \frac{\pi}{4} = \boldsymbol{\frac{\pi}{12}}$.

11. $Area\ of\ Region\ A$: $\int_0^1 x^{\frac{1}{3}} - xdx = \frac{3}{4}x^{\frac{4}{3}} - \left(\frac{1}{2}\right)x^2|_0^1 = \frac{1}{4}$

$Area\ of\ Region\ B$: $\int_1^2 -x^{\frac{1}{3}} + xdx = \frac{3}{-4}x^{\frac{4}{3}} + \left(\frac{1}{2}\right)x^2|_1^2 = \frac{9}{4} - \frac{3}{4}(2\sqrt[3]{2})$

Sum = $\mathbf{\frac{5-3\sqrt[3]{2}}{2}}$

12. $V = h(14-2h)(10-2h) = 4h^3 - 48h^2 + 140h$

$\frac{dV}{dt} = 12h^2 - 96h + 140$; $12h^2 - 96h + 140 = 0 = 3h^2 - 24h + 35$; Using Quadratic formula: $h = \frac{24 \pm 2\sqrt{39}}{6}$ By checking to see which would give the max volume, I find that h must equal $h = \mathbf{\frac{12-\sqrt{39}}{3}}$

13. $y = 6(x^2+3)^{-1}$; $\frac{dy}{dx} = -6(x^2+3)^{-2}(2x)$

To find the minimum slope, we must differentiate the slope and set equal to zero . Using product rule: $\frac{d^2y}{dx^2} = -12(x^2+3)^{-2} + (-2)(x^2+3)^{-3}(2x)(-12x) = 0$; $\frac{-12(x^2+3)+48x^2}{(x^2+3)^3} = 0$; $-12(x^2+3) + 48x^2 = 0$; $48x^2 - 12x^2 - 36 = 0$; $36x^2 - 36 = 0$; $x = \pm 1$; $\frac{dy}{dx}(1) = -\frac{12}{16}$; $\frac{dy}{dx}(-1) = \frac{12}{16}$ so the minimum is x=**1**.

14. To be continuous: 4a+b=-16+a ; b = -16 – 3a

To be differentiable: 2ax=-8 ; 2(2)a = -8 ; a=-2. By Substitution: b = -10.

Sum = **-12**

15. $\int_0^{\frac{\pi}{4}} \sec^2 xdx + \int_0^{\frac{\pi}{4}} \sec^2 xtanxdx$

The first integral can be found easily, but the second you must use a u – substitution. $tanx + \frac{1}{2}\tan^2 x|_0^{\frac{\pi}{4}} = \mathbf{\frac{3}{2}}$

16. Tangent is the ratio of sine to cosine, so this expression can simplify to:

$\int_0^{\frac{\pi}{20}} \sin(5x)\,dx = -\frac{1}{5}\cos(5x)\Big|_0^{\frac{\pi}{20}} = \mathbf{\frac{2-\sqrt{2}}{10}}$

17. By doing a u-substitution with u = sin(x), and du = -cos(x)dx, we can rewrite the integral: $\int_0^{\frac{\pi}{2}} 2^u du = \frac{1}{ln2}2^{sinx}\Big|_0^{\frac{\pi}{2}} = \frac{1}{ln2}$. The reciprocal is $\boldsymbol{ln2}$.

18. The slope of the two lines forming the absolute value graph will be 1 or -1. At x = 4, the line is growing at a slope of **1**.

19. By using disk method: $2\pi\int_0^1\left(\sqrt{1-x^2}\right)^2dx;\ 2\pi\int_0^1 1-x^2dx; 2\pi[x-\frac{1}{3}x^3]\Big|_0^1\Big| = \boldsymbol{\frac{4}{3}\pi}$

20. This integral requires a u sub and partial fractions. u = e^x

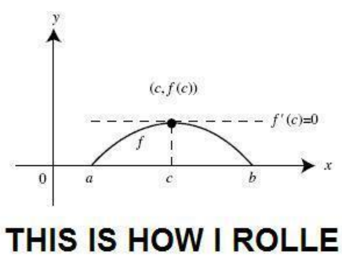
$\int\frac{u}{(u+2)(u+1)}\left(\frac{du}{u}\right)=\int\frac{du}{(u+2)(u+1)}=\int\frac{-1}{u+2}du+\int\frac{1}{u+1}du=ln\left|\frac{e^x+1}{e^x+2}\right|\Big|_0^1 = ln\left(\frac{e+1}{e+2}\right)-ln\frac{2}{3}.\ A=\boldsymbol{\frac{3e+3}{2e+4}}.$

21. By Using L'Hospital's: $\boldsymbol{\lim_{x\to0}\frac{\left(\frac{1}{2}\right)(25-x^2)^{-\frac{1}{2}}(-2x)}{1}=0}$

22. This is a slope field for a circle, which has eccentricity of **0**.

23. $f(x)=2ln(x-1)-ln(x+2)\to f'(x)=\frac{2}{x-1}-\frac{1}{x+2}\to f'^{(7)}=\frac{2}{6}-\frac{1}{9}=\boldsymbol{\frac{2}{9}}.$

24. **Rolle**'s Theorem



25.

If f is differentiable at a point x_0, then f must also be continuous at x_0. In particular, any differentiable function must be continuous at every point in its domain. The converse does not hold: a continuous function need not be differentiable.

That makes the x-values where it is not differentiable at: 1, 2, and 4. Sum = **7**