Blue:

1. A
2. C
3. E
4. B
5. D
6. A
7. A
8. B
9. D
10. E
11. E
12. E
13. C
14. B
15. D
16. A
17. A
18. B
19. B
20. E

21. A
22. B
23. D
24. C
25. D
26. B
27. C
28. A
29. E
30. C
31. A
32. B
33. A
34. E
35. A
36. E
37. B
38. C
39. C
40. C
41. C
42. E
43. A
44. E
45. D

3.

$$\int_0^x P^3$$

2.

$$\lim_{x\to 0} \frac{\cancel{2x^2} \cancel{+1} - \cancel{1}}{\cancel{x^2}} = 2$$

$$\frac{2x^2}{x^2}$$

4.

$$x\frac{dy}{dt} + y\frac{dx}{dt} = 0$$

6.

$$x = t^2+1 \qquad y = t^3$$

$$\frac{dy}{dx} = \frac{3t^2}{2t} = \frac{3}{2}t$$

$$\frac{d^2y}{dx^2} = \frac{\frac{3}{2}}{2t}$$

8.

$$f(x) = \ln(e^{2x})$$

$$(2x)\ln e = 2x$$

$$f'(x) = 2$$

$$\frac{1}{\cancel{e^{2x}}} \cdot \cancel{e^{2x}} \cdot 2$$

7.

$$\int_0^1 x^3 e^{x^4}\,dx$$

$$u = x^4$$
$$du = 4x^3\,dx$$

$$\int \cancel{x^3} e^u \frac{du}{4\cancel{x^3}}$$

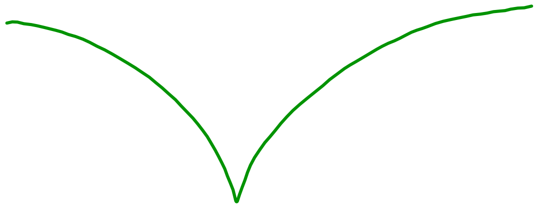
$$\frac{1}{4}\int e^u\,du$$

$$\frac{1}{4}e^u \rightarrow \frac{1}{4}e^{x^4}\Big|_0^1$$

$$\frac{1}{4}(e^1) - \frac{1}{4}e^0$$

$$\frac{1}{4}e - \frac{1}{4} = \frac{1}{4}(e-1)$$

9.



11. $\displaystyle\int_4^\infty \frac{-2x}{\sqrt[3]{9-x^2}}\,dx$

$u = 9 - x^2$

$du = -2x\,dx$

$\displaystyle\int \frac{1}{u^{\frac{1}{3}}}\,du \qquad \int u^{-\frac{1}{3}}\,du$

$\frac{3}{2}u^{\frac{2}{3}}$

$\frac{3}{2}(9-x^2)^{\frac{2}{3}}\Big|_4^\infty$

$\displaystyle\lim_{b\to\infty}\left(\frac{3}{2}(9-b^2)^{\frac{2}{3}} - \frac{3}{2}(9-4^2)^{\frac{2}{3}}\right)$

∞

13.

$$\frac{dy}{dx} = x^2 y$$

$$\int \frac{dy}{y} = \int x^2\,dx$$

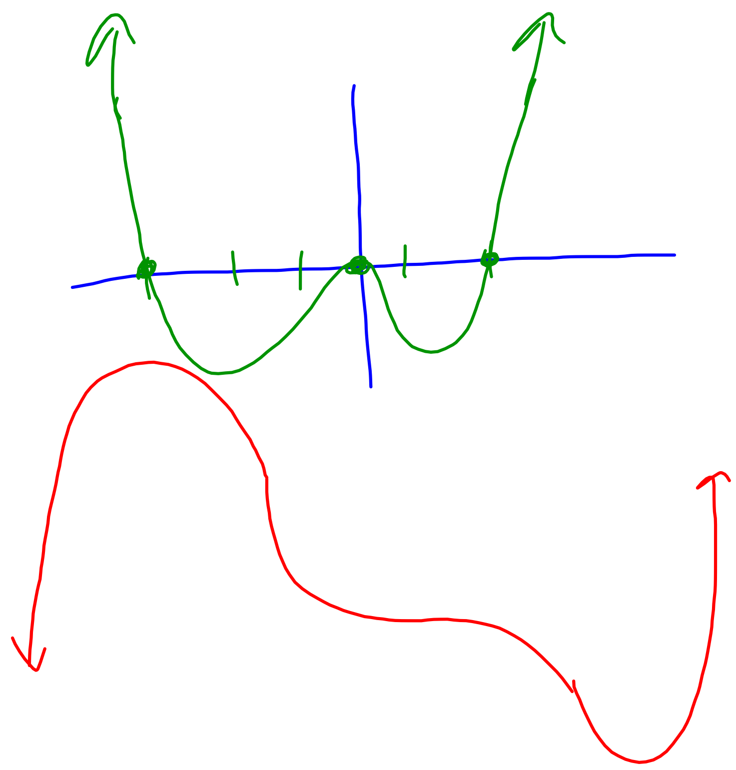
$$\ln y = \frac{x^3}{3} + C$$

$$e^{\frac{x^3}{3} + C} = y$$

$$e^{\frac{x^3}{3}} \cdot e^{C}$$

$$y = Ce^{\frac{x^3}{3}}$$

14.



17.

$$\ln(xy) = x$$

$\ln y = 1$

$y = e$

$$\frac{1}{xy} \cdot \left(x\frac{dy}{dx} + y\right) = 1$$

$$\cancel{\frac{1}{y}}\left(\frac{dy}{dx} + y\right) = 1 \cdot y$$

$$\frac{dy}{dx} + y = y$$

$$\frac{dy}{dx} = 0$$

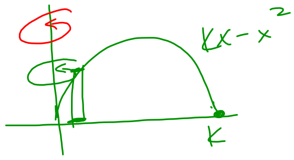
18.

$$e^{f(x)} = 1 + x^2$$

$$f(x) = \ln\left(1 + x^2\right)$$

$$f'(x)$$

19.



$$\int 2\pi r h$$

$$\cancel{2\pi}\int_0^k (x)(kx-x^2)\,dx = \frac{10}{2\pi}$$

$$kx^2 - x^3$$

$$\left.\frac{kx^3}{3} - \frac{x^4}{4}\right|_0^k = \frac{5}{\pi}$$

$$4 \cdot \frac{k^4}{3} - \frac{3 \cdot k^4}{4} = \frac{5}{\pi}$$

$$\frac{k^4}{\cancel{12}} = \sqrt[4]{\frac{5}{\pi} \cdot 12}$$

$$\left(\frac{60}{\pi}\right)^{\frac{1}{4}}$$

20.

$$a(t) = e^{-2t}$$

$$v(t) = \frac{5}{2} + \int_0^t e^{-2x}\,dx$$

$$v(t) = \frac{5}{2} + \left(\left.\frac{e^{-2x}}{-2}\right|_0^t\right)$$

$$v(t) = \frac{5}{2} + \left(\frac{e^{-2t}}{-2} - \frac{1}{-2}\right)$$

$$v(t) = 3 + \frac{e^{-2t}}{-2}$$

$$x(t) = \frac{17}{4} + \int_0^t \left(3 + \frac{e^{-2x}}{-2}\right) dx$$

$$\frac{17}{4} + \left(\left. 3x + \frac{e^{-2x}}{4}\right|_0^t\right)$$

$$\underline{\underline{v(t)}} = y_0 + \int_{x_0}^{x} \underline{\underline{a(t)}}$$

$\cancel{x}3 = e^t \qquad y = te^{-t}$

$t = \ln 3$

$$\frac{dy}{dx} = \frac{t(-e^{-t}) + e^{-t}}{e^t}$$

29.

$$\int x \sec^2 x \, dx$$

$u = x \qquad dv = \sec^2 x$

$$\begin{array}{c|c} x & \sec^2 x \, dx \\ \hline 1 & \tan x \\ 0 & -\ln|\cos x| \end{array}$$

$\frac{\sin x}{\cos x}$

$u = \cos x$

$du = -\sin x \, dx$

$\int \frac{-1}{u} du$

$-\ln|u|$

31.

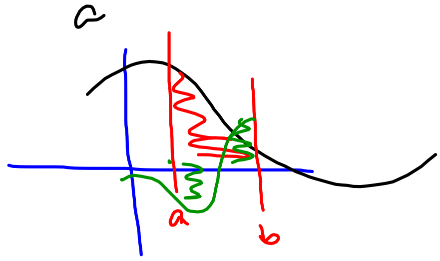
$$\frac{(5+n)^{100}}{5^{n+1}} \cdot \frac{\cancel{5^{n}}}{(4+n)^{100}}$$

$$\lim_{n\to\infty} \cancel{\frac{(5+n)^{100}}{(4+n)^{100}}} \cdot \frac{1}{5}$$

1

32.

$$\int_a^b f(x)\,dx = 5 \qquad \int_a^b g(x)\,dx = -1$$



$$\int_a^b \Big(f(x) + g(x)\Big)dx = 5 + -1$$

4.

$$x\frac{dy}{dt} + y\frac{dx}{dt} = 0$$

$$2(3) + 5\frac{dx}{dt} = 0$$

6.

$$\frac{d^2y}{dx^2}$$

$$x = t^2 + 1 \quad y = t^3$$

$$\frac{dy}{dx} = \frac{3t^2}{2t} = \frac{3}{2}t$$

$$\frac{\frac{d^2y}{dx \cdot \cancel{dt}} \cdot \frac{\cancel{dt}}{dx}}{\cancel{\frac{dx}{dt}}} \cdot \frac{\frac{3}{2} \cdot \frac{1}{2t}}{\cancel{2t}} = \frac{3}{4t}$$

8.

$$y = \ln(e^{2x})$$

$$(2x)\cancel{\ln e}$$

$$2$$

$$\frac{1}{\cancel{e^{2x}}} \cdot \cancel{e^{2x}} \cdot 2$$

11.

$$\int_4^\infty \frac{-2x}{\sqrt[3]{9-x^2}}\,dx$$

$u = 9 - x^2$
$du = -2x\,dx$

$$\int \frac{1}{u^{\frac{1}{3}}}\,du \qquad \int u^{-\frac{1}{3}}\,du$$

$$\frac{3}{2}u^{\frac{2}{3}} \rightarrow \left(\frac{3}{2}(9-x^2)^{\frac{2}{3}}\Big|_4^\infty\right)$$

$$\lim_{b \to \infty}\left(\frac{3}{2}(9-b^2)^{\frac{2}{3}} - \frac{3}{2}(9-4^2)^{\frac{2}{3}}\right)$$

$$\infty$$

13. $\frac{dy}{dx} = x^2 y$

$$\frac{dy}{y} = x^2 dx$$

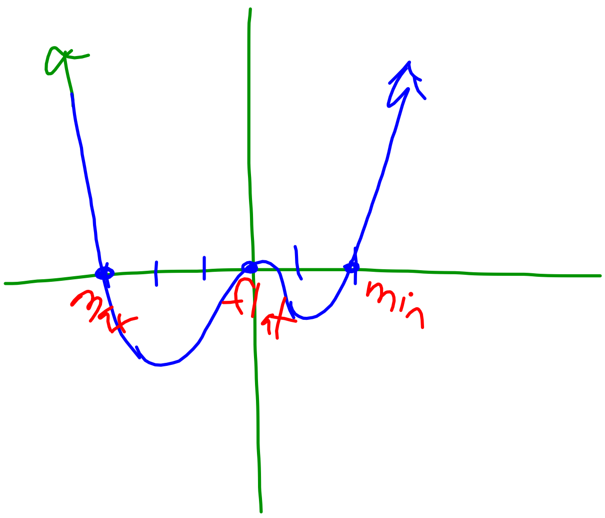
$$\ln y = \frac{x^3}{3} + C$$

$$y = e^{\frac{x^3}{3} + C}$$

$$y = e^{C} \cdot e^{\frac{x^3}{3}}$$

$$y = Ce^{\frac{x^3}{3}}$$

14.



15.

$$y = e^{\tan^2 x}$$

$$y' = e^{\tan^2 x} \cdot 2\tan x \cdot \sec^2 x$$

17.

$$\ln(xy) = x \qquad @\, x = 1$$

$$\ln y = 1$$

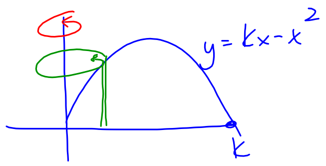
$$\frac{1}{xy} \cdot \left(x\frac{dy}{dx} + y\right) = 1$$

$$\frac{\cancel{x}}{y}\left(\frac{dy}{dx} + y\right) = 1 \cdot y$$

$$-y \qquad -y$$

$$\frac{dy}{dx} = 0$$

19.



$$2\pi \int r h$$

$$2\pi \int_0^k x(kx - x^2)\,dx = 10$$

$$kx^2 - x^3$$

$$2\pi\left(\frac{kx^3}{3} - \frac{x^4}{4}\Bigg|_0^k\right) = 10$$

$$2\pi\left(\frac{k^4}{3} - \frac{k^4}{4}\right) = 10$$

$$\cancel{2}\pi\left(\frac{k^4}{\cancel{12}\ \cancel{6}}\right) = \frac{10}{\pi}\cdot 6$$

$$k^4 = \frac{60}{\pi}$$

$$v(t) = y_0 + \int_{x_0}^{x} a(t)\,dt$$

$$v(t) = \frac{5}{2} + \int_0^x e^{-2t}\,dt$$

$$v(t) = \frac{5}{2} + \left(\frac{e^{-2t}}{-2}\Bigg|_0^x\right)$$

$$= \frac{5}{2} + \frac{e^{-2x}}{-2} - \left(\frac{-1}{2}\right)$$

$$v(t) = 3 + \frac{e^{-2x}}{-2}$$

$$x(t) = \frac{17}{4} + \int_0^t 3 - \frac{e^{-2x}}{2}\,dx$$

21. $\ln y = \ln\left(\dfrac{(x^2+8)^{\frac{1}{3}}}{(2x+1)^{\frac{1}{4}}}\right)$

$$\ln y = \frac{1}{3}\ln(x^2+8) - \frac{1}{4}\ln(2x+1)$$

$$\frac{1}{y}\frac{dy}{dx} = \cancel{\frac{1}{3}\left(\frac{1}{x^2+8}\right)2x} - \frac{1}{\cancel{4}}\left(\frac{1}{2x+1}\right)\cdot\cancel{2}$$

$$-\frac{1}{2}(1) \qquad y = 2$$

$$\frac{dy}{dx} = -\frac{1}{2}(y)$$

$$\lim_{x\to 0}\frac{f(x)}{g(x)}$$

25.

$x = e^t \qquad y = te^{-t} \qquad x = 3$

$3 = e^t$

$t = \ln 3$

$$\frac{dy}{dx} = \frac{t(-e^{-t}) + e^{-t}}{e^t}$$

$$\ln 3\left(-e^{-\ln 3}\right) + e^{-\ln 3}$$

$$\frac{-\frac{1}{3}\ln 3 - \frac{1}{3}}{3} =$$

26.

$$y = \tan^{-1}\left(e^{2x}\right)$$

$$= \frac{1}{\left(e^{2x}\right)^2 + 1} \cdot e^{2x} \cdot 2$$

$$\frac{2e^{2x}}{e^{4x} + 1}$$

29.

$$\int x \sec^2 x \, dx$$

x	$\sec^2 x$
1	$+$ $\tan x$
0	$-$ $-\ln\lvert\cos x\rvert$

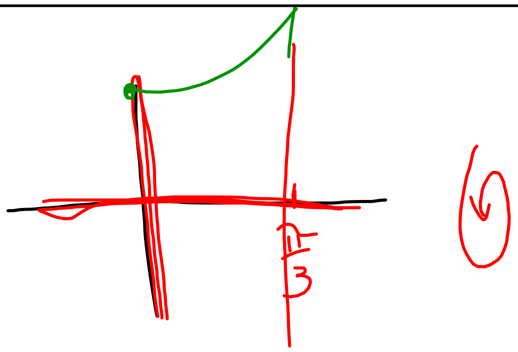
$\frac{\sin x}{\cos x}$

$u = \cos x$

$du = -\sin x$

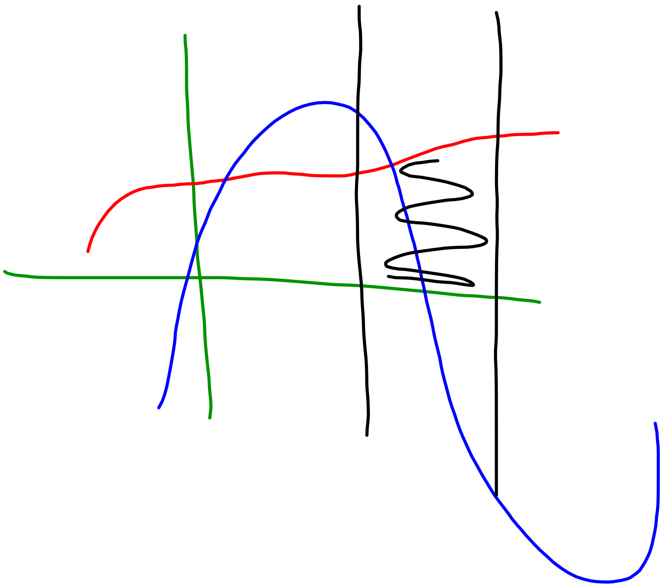
$-\int \frac{1}{u}$

30.



$$\pi \int_0^{\frac{\pi}{3}} (\sec x)^2 \, dx$$

32.



31.

$$\left(\frac{(5+n)^{100}}{(4+n)^{100}}\right)\frac{\cancel{5^{n}}}{5^{\cancel{n}+1}}$$