





1.  $y = \frac{1}{x} + \frac{1}{x^2}$   
 $\frac{dy}{dx} = -\frac{1}{x^2} - \frac{2}{x^3}$   
 $\frac{d^2y}{dx^2} = \frac{2}{x^3} + \frac{6}{x^4}$   
 $\frac{d^3y}{dx^3} = -\frac{18}{x^4} - \frac{24}{x^5}$   
 $\frac{d^4y}{dx^4} = \frac{72}{x^5} + \frac{120}{x^6}$   
 $\frac{d^5y}{dx^5} = -\frac{360}{x^6} - \frac{720}{x^7}$   
 $\frac{d^6y}{dx^6} = \frac{1440}{x^7} + \frac{3360}{x^8}$   
 $\frac{d^7y}{dx^7} = -\frac{6720}{x^8} - \frac{15120}{x^9}$   
 $\frac{d^8y}{dx^8} = \frac{30240}{x^9} + \frac{6720}{x^{10}}$   
 $\frac{d^9y}{dx^9} = -\frac{15120}{x^{10}} - \frac{30240}{x^{11}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{70560}{x^{11}} + \frac{14016}{x^{12}}$

2.  $y = \sin(\ln x)$   
 $\frac{dy}{dx} = \cos(\ln x) + \frac{\sin x}{x}$   
 $\frac{d^2y}{dx^2} = \frac{\sin x}{x} + \frac{\cos x}{x^2}$   
 $\frac{d^3y}{dx^3} = \frac{1}{x^2} \left( \frac{2\cos x - x\sin x}{x^2} \right)$   
 $\frac{d^4y}{dx^4} = \frac{1}{x^4} \left( \frac{-4\cos x + 3x\sin x}{x^4} \right)$   
 $\frac{d^5y}{dx^5} = \frac{1}{x^6} \left( \frac{12\cos x - 10x\sin x}{x^6} \right)$   
 $\frac{d^6y}{dx^6} = \frac{1}{x^8} \left( \frac{-48\cos x + 35x\sin x}{x^8} \right)$   
 $\frac{d^7y}{dx^7} = \frac{1}{x^{10}} \left( \frac{168\cos x - 140x\sin x}{x^{10}} \right)$   
 $\frac{d^8y}{dx^8} = \frac{1}{x^{12}} \left( \frac{-560\cos x + 420x\sin x}{x^{12}} \right)$   
 $\frac{d^9y}{dx^9} = \frac{1}{x^{14}} \left( \frac{2520\cos x - 1820x\sin x}{x^{14}} \right)$   
 $\frac{d^{10}y}{dx^{10}} = \frac{1}{x^{16}} \left( \frac{-9120\cos x + 6300x\sin x}{x^{16}} \right)$

3.  $y = \ln(\tan x) + \ln(\sec x)$   
 $\frac{dy}{dx} = \frac{1}{\tan x} + \frac{1}{\sec x}$   
 $\frac{d^2y}{dx^2} = -\frac{1}{\tan^2 x} - \frac{1}{\sec^2 x}$   
 $\frac{d^3y}{dx^3} = \frac{2}{\tan^3 x} + \frac{2}{\sec^3 x}$   
 $\frac{d^4y}{dx^4} = -\frac{6}{\tan^4 x} - \frac{6}{\sec^4 x}$   
 $\frac{d^5y}{dx^5} = \frac{20}{\tan^5 x} + \frac{20}{\sec^5 x}$   
 $\frac{d^6y}{dx^6} = -\frac{70}{\tan^6 x} - \frac{70}{\sec^6 x}$   
 $\frac{d^7y}{dx^7} = \frac{252}{\tan^7 x} + \frac{252}{\sec^7 x}$   
 $\frac{d^8y}{dx^8} = -\frac{912}{\tan^8 x} - \frac{912}{\sec^8 x}$   
 $\frac{d^9y}{dx^9} = \frac{3456}{\tan^9 x} + \frac{3456}{\sec^9 x}$   
 $\frac{d^{10}y}{dx^{10}} = -\frac{12672}{\tan^{10} x} - \frac{12672}{\sec^{10} x}$

4.  $y = e^{x^2}$   
 $\frac{dy}{dx} = 2xe^{x^2}$   
 $\frac{d^2y}{dx^2} = 2e^{x^2} + 4x^2e^{x^2}$   
 $\frac{d^3y}{dx^3} = 4e^{x^2} + 12x^2e^{x^2}$   
 $\frac{d^4y}{dx^4} = 8e^{x^2} + 48x^2e^{x^2}$   
 $\frac{d^5y}{dx^5} = 16e^{x^2} + 120x^2e^{x^2}$   
 $\frac{d^6y}{dx^6} = 32e^{x^2} + 240x^2e^{x^2}$   
 $\frac{d^7y}{dx^7} = 64e^{x^2} + 480x^2e^{x^2}$   
 $\frac{d^8y}{dx^8} = 128e^{x^2} + 960x^2e^{x^2}$   
 $\frac{d^9y}{dx^9} = 256e^{x^2} + 1920x^2e^{x^2}$   
 $\frac{d^{10}y}{dx^{10}} = 512e^{x^2} + 3840x^2e^{x^2}$

5.  $y = \frac{x}{e^x}$   
 $\frac{dy}{dx} = \frac{1-x}{e^x}$   
 $\frac{d^2y}{dx^2} = \frac{2}{e^x} - \frac{2x}{e^{2x}}$   
 $\frac{d^3y}{dx^3} = \frac{4}{e^x} - \frac{6x}{e^{3x}}$   
 $\frac{d^4y}{dx^4} = \frac{8}{e^x} - \frac{18x}{e^{4x}}$   
 $\frac{d^5y}{dx^5} = \frac{16}{e^x} - \frac{42x}{e^{5x}}$   
 $\frac{d^6y}{dx^6} = \frac{32}{e^x} - \frac{90x}{e^{6x}}$   
 $\frac{d^7y}{dx^7} = \frac{64}{e^x} - \frac{156x}{e^{7x}}$   
 $\frac{d^8y}{dx^8} = \frac{128}{e^x} - \frac{252x}{e^{8x}}$   
 $\frac{d^9y}{dx^9} = \frac{256}{e^x} - \frac{420x}{e^{9x}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{512}{e^x} - \frac{720x}{e^{10x}}$

6.  $y = \ln(\ln x)$   
 $\frac{dy}{dx} = \frac{1}{x\ln x}$   
 $\frac{d^2y}{dx^2} = -\frac{1}{x^2\ln x} + \frac{1}{x^2}$   
 $\frac{d^3y}{dx^3} = \frac{2}{x^3} - \frac{3}{x^4}$   
 $\frac{d^4y}{dx^4} = -\frac{8}{x^5} + \frac{12}{x^6}$   
 $\frac{d^5y}{dx^5} = \frac{40}{x^7} - \frac{60}{x^8}$   
 $\frac{d^6y}{dx^6} = -\frac{160}{x^9} + \frac{240}{x^{10}}$   
 $\frac{d^7y}{dx^7} = \frac{640}{x^{11}} - \frac{960}{x^{12}}$   
 $\frac{d^8y}{dx^8} = -\frac{2560}{x^{13}} + \frac{3840}{x^{14}}$   
 $\frac{d^9y}{dx^9} = \frac{9600}{x^{15}} - \frac{14400}{x^{16}}$   
 $\frac{d^{10}y}{dx^{10}} = -\frac{38400}{x^{17}} + \frac{57600}{x^{18}}$

7.  $y = \frac{1}{x^2}$   
 $\frac{dy}{dx} = -\frac{2}{x^3}$   
 $\frac{d^2y}{dx^2} = \frac{6}{x^4}$   
 $\frac{d^3y}{dx^3} = -\frac{18}{x^5}$   
 $\frac{d^4y}{dx^4} = \frac{48}{x^6}$   
 $\frac{d^5y}{dx^5} = -\frac{120}{x^7}$   
 $\frac{d^6y}{dx^6} = \frac{240}{x^8}$   
 $\frac{d^7y}{dx^7} = -\frac{420}{x^9}$   
 $\frac{d^8y}{dx^8} = \frac{720}{x^{10}}$   
 $\frac{d^9y}{dx^9} = -\frac{1260}{x^{11}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{1920}{x^{12}}$

8.  $y = \frac{1}{x^3}$   
 $\frac{dy}{dx} = -\frac{3}{x^4}$   
 $\frac{d^2y}{dx^2} = \frac{12}{x^5}$   
 $\frac{d^3y}{dx^3} = -\frac{36}{x^6}$   
 $\frac{d^4y}{dx^4} = \frac{120}{x^7}$   
 $\frac{d^5y}{dx^5} = -\frac{300}{x^8}$   
 $\frac{d^6y}{dx^6} = \frac{1200}{x^9}$   
 $\frac{d^7y}{dx^7} = -\frac{3360}{x^{10}}$   
 $\frac{d^8y}{dx^8} = \frac{13440}{x^{11}}$   
 $\frac{d^9y}{dx^9} = -\frac{33600}{x^{12}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{134400}{x^{13}}$

9.  $y = \frac{1}{x^4}$   
 $\frac{dy}{dx} = -\frac{4}{x^5}$   
 $\frac{d^2y}{dx^2} = \frac{20}{x^6}$   
 $\frac{d^3y}{dx^3} = -\frac{60}{x^7}$   
 $\frac{d^4y}{dx^4} = \frac{240}{x^8}$   
 $\frac{d^5y}{dx^5} = -\frac{600}{x^9}$   
 $\frac{d^6y}{dx^6} = \frac{2400}{x^{10}}$   
 $\frac{d^7y}{dx^7} = -\frac{6000}{x^{11}}$   
 $\frac{d^8y}{dx^8} = \frac{24000}{x^{12}}$   
 $\frac{d^9y}{dx^9} = -\frac{60000}{x^{13}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{240000}{x^{14}}$

10.  $y = \frac{1}{x^5}$   
 $\frac{dy}{dx} = -\frac{5}{x^6}$   
 $\frac{d^2y}{dx^2} = \frac{30}{x^7}$   
 $\frac{d^3y}{dx^3} = -\frac{90}{x^8}$   
 $\frac{d^4y}{dx^4} = \frac{360}{x^9}$   
 $\frac{d^5y}{dx^5} = -\frac{900}{x^{10}}$   
 $\frac{d^6y}{dx^6} = \frac{3600}{x^{11}}$   
 $\frac{d^7y}{dx^7} = -\frac{9000}{x^{12}}$   
 $\frac{d^8y}{dx^8} = \frac{36000}{x^{13}}$   
 $\frac{d^9y}{dx^9} = -\frac{90000}{x^{14}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{360000}{x^{15}}$

11.  $y = \frac{1}{x^6}$   
 $\frac{dy}{dx} = -\frac{6}{x^7}$   
 $\frac{d^2y}{dx^2} = \frac{42}{x^8}$   
 $\frac{d^3y}{dx^3} = -\frac{126}{x^9}$   
 $\frac{d^4y}{dx^4} = \frac{504}{x^{10}}$   
 $\frac{d^5y}{dx^5} = -\frac{1260}{x^{11}}$   
 $\frac{d^6y}{dx^6} = \frac{5040}{x^{12}}$   
 $\frac{d^7y}{dx^7} = -\frac{12600}{x^{13}}$   
 $\frac{d^8y}{dx^8} = \frac{50400}{x^{14}}$   
 $\frac{d^9y}{dx^9} = -\frac{126000}{x^{15}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{504000}{x^{16}}$

12.  $y = \frac{1}{x^7}$   
 $\frac{dy}{dx} = -\frac{7}{x^8}$   
 $\frac{d^2y}{dx^2} = \frac{56}{x^9}$   
 $\frac{d^3y}{dx^3} = -\frac{168}{x^{10}}$   
 $\frac{d^4y}{dx^4} = \frac{840}{x^{11}}$   
 $\frac{d^5y}{dx^5} = -\frac{1680}{x^{12}}$   
 $\frac{d^6y}{dx^6} = \frac{8400}{x^{13}}$   
 $\frac{d^7y}{dx^7} = -\frac{16800}{x^{14}}$   
 $\frac{d^8y}{dx^8} = \frac{84000}{x^{15}}$   
 $\frac{d^9y}{dx^9} = -\frac{168000}{x^{16}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{840000}{x^{17}}$

13.  $y = \frac{1}{x^8}$   
 $\frac{dy}{dx} = -\frac{8}{x^9}$   
 $\frac{d^2y}{dx^2} = \frac{72}{x^{10}}$   
 $\frac{d^3y}{dx^3} = -\frac{216}{x^{11}}$   
 $\frac{d^4y}{dx^4} = \frac{1440}{x^{12}}$   
 $\frac{d^5y}{dx^5} = -\frac{2160}{x^{13}}$   
 $\frac{d^6y}{dx^6} = \frac{14400}{x^{14}}$   
 $\frac{d^7y}{dx^7} = -\frac{21600}{x^{15}}$   
 $\frac{d^8y}{dx^8} = \frac{144000}{x^{16}}$   
 $\frac{d^9y}{dx^9} = -\frac{216000}{x^{17}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{1440000}{x^{18}}$

14.  $y = \frac{1}{x^9}$   
 $\frac{dy}{dx} = -\frac{9}{x^{10}}$   
 $\frac{d^2y}{dx^2} = \frac{180}{x^{11}}$   
 $\frac{d^3y}{dx^3} = -\frac{540}{x^{12}}$   
 $\frac{d^4y}{dx^4} = \frac{3600}{x^{13}}$   
 $\frac{d^5y}{dx^5} = -\frac{5400}{x^{14}}$   
 $\frac{d^6y}{dx^6} = \frac{36000}{x^{15}}$   
 $\frac{d^7y}{dx^7} = -\frac{54000}{x^{16}}$   
 $\frac{d^8y}{dx^8} = \frac{360000}{x^{17}}$   
 $\frac{d^9y}{dx^9} = -\frac{540000}{x^{18}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{3600000}{x^{19}}$

15.  $y = \frac{1}{x^{10}}$   
 $\frac{dy}{dx} = -\frac{10}{x^{11}}$   
 $\frac{d^2y}{dx^2} = \frac{360}{x^{12}}$   
 $\frac{d^3y}{dx^3} = -\frac{1080}{x^{13}}$   
 $\frac{d^4y}{dx^4} = \frac{7200}{x^{14}}$   
 $\frac{d^5y}{dx^5} = -\frac{10800}{x^{15}}$   
 $\frac{d^6y}{dx^6} = \frac{72000}{x^{16}}$   
 $\frac{d^7y}{dx^7} = -\frac{108000}{x^{17}}$   
 $\frac{d^8y}{dx^8} = \frac{720000}{x^{18}}$   
 $\frac{d^9y}{dx^9} = -\frac{1080000}{x^{19}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{7200000}{x^{20}}$

16.  $y = \frac{1}{x^{11}}$   
 $\frac{dy}{dx} = -\frac{11}{x^{12}}$   
 $\frac{d^2y}{dx^2} = \frac{462}{x^{13}}$   
 $\frac{d^3y}{dx^3} = -\frac{1452}{x^{14}}$   
 $\frac{d^4y}{dx^4} = \frac{13200}{x^{15}}$   
 $\frac{d^5y}{dx^5} = -\frac{14520}{x^{16}}$   
 $\frac{d^6y}{dx^6} = \frac{132000}{x^{17}}$   
 $\frac{d^7y}{dx^7} = -\frac{145200}{x^{18}}$   
 $\frac{d^8y}{dx^8} = \frac{1320000}{x^{19}}$   
 $\frac{d^9y}{dx^9} = -\frac{1452000}{x^{20}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{13200000}{x^{21}}$

17.  $y = \frac{1}{x^{12}}$   
 $\frac{dy}{dx} = -\frac{12}{x^{13}}$   
 $\frac{d^2y}{dx^2} = \frac{504}{x^{14}}$   
 $\frac{d^3y}{dx^3} = -\frac{1680}{x^{15}}$   
 $\frac{d^4y}{dx^4} = \frac{16800}{x^{16}}$   
 $\frac{d^5y}{dx^5} = -\frac{168000}{x^{17}}$   
 $\frac{d^6y}{dx^6} = \frac{1680000}{x^{18}}$   
 $\frac{d^7y}{dx^7} = -\frac{16800000}{x^{19}}$   
 $\frac{d^8y}{dx^8} = \frac{168000000}{x^{20}}$   
 $\frac{d^9y}{dx^9} = -\frac{1680000000}{x^{21}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{16800000000}{x^{22}}$

18.  $y = \frac{1}{x^{13}}$   
 $\frac{dy}{dx} = -\frac{13}{x^{14}}$   
 $\frac{d^2y}{dx^2} = \frac{672}{x^{15}}$   
 $\frac{d^3y}{dx^3} = -\frac{2352}{x^{16}}$   
 $\frac{d^4y}{dx^4} = \frac{23520}{x^{17}}$   
 $\frac{d^5y}{dx^5} = -\frac{235200}{x^{18}}$   
 $\frac{d^6y}{dx^6} = \frac{2352000}{x^{19}}$   
 $\frac{d^7y}{dx^7} = -\frac{23520000}{x^{20}}$   
 $\frac{d^8y}{dx^8} = \frac{235200000}{x^{21}}$   
 $\frac{d^9y}{dx^9} = -\frac{2352000000}{x^{22}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{23520000000}{x^{23}}$

19.  $y = \frac{1}{x^{14}}$   
 $\frac{dy}{dx} = -\frac{14}{x^{15}}$   
 $\frac{d^2y}{dx^2} = \frac{840}{x^{16}}$   
 $\frac{d^3y}{dx^3} = -\frac{2912}{x^{17}}$   
 $\frac{d^4y}{dx^4} = \frac{29120}{x^{18}}$   
 $\frac{d^5y}{dx^5} = -\frac{291200}{x^{19}}$   
 $\frac{d^6y}{dx^6} = \frac{2912000}{x^{20}}$   
 $\frac{d^7y}{dx^7} = -\frac{29120000}{x^{21}}$   
 $\frac{d^8y}{dx^8} = \frac{291200000}{x^{22}}$   
 $\frac{d^9y}{dx^9} = -\frac{2912000000}{x^{23}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{29120000000}{x^{24}}$

20.  $y = \frac{1}{x^{15}}$   
 $\frac{dy}{dx} = -\frac{15}{x^{16}}$   
 $\frac{d^2y}{dx^2} = \frac{1008}{x^{17}}$   
 $\frac{d^3y}{dx^3} = -\frac{3780}{x^{18}}$   
 $\frac{d^4y}{dx^4} = \frac{37800}{x^{19}}$   
 $\frac{d^5y}{dx^5} = -\frac{378000}{x^{20}}$   
 $\frac{d^6y}{dx^6} = \frac{3780000}{x^{21}}$   
 $\frac{d^7y}{dx^7} = -\frac{37800000}{x^{22}}$   
 $\frac{d^8y}{dx^8} = \frac{378000000}{x^{23}}$   
 $\frac{d^9y}{dx^9} = -\frac{3780000000}{x^{24}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{37800000000}{x^{25}}$

21.  $y = \frac{1}{x^{16}}$   
 $\frac{dy}{dx} = -\frac{16}{x^{17}}$   
 $\frac{d^2y}{dx^2} = \frac{1260}{x^{18}}$   
 $\frac{d^3y}{dx^3} = -\frac{4830}{x^{19}}$   
 $\frac{d^4y}{dx^4} = \frac{48300}{x^{20}}$   
 $\frac{d^5y}{dx^5} = -\frac{483000}{x^{21}}$   
 $\frac{d^6y}{dx^6} = \frac{4830000}{x^{22}}$   
 $\frac{d^7y}{dx^7} = -\frac{48300000}{x^{23}}$   
 $\frac{d^8y}{dx^8} = \frac{483000000}{x^{24}}$   
 $\frac{d^9y}{dx^9} = -\frac{4830000000}{x^{25}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{48300000000}{x^{26}}$

22.  $y = \frac{1}{x^{17}}$   
 $\frac{dy}{dx} = -\frac{17}{x^{18}}$   
 $\frac{d^2y}{dx^2} = \frac{1512}{x^{19}}$   
 $\frac{d^3y}{dx^3} = -\frac{5988}{x^{20}}$   
 $\frac{d^4y}{dx^4} = \frac{59880}{x^{21}}$   
 $\frac{d^5y}{dx^5} = -\frac{598800}{x^{22}}$   
 $\frac{d^6y}{dx^6} = \frac{5988000}{x^{23}}$   
 $\frac{d^7y}{dx^7} = -\frac{59880000}{x^{24}}$   
 $\frac{d^8y}{dx^8} = \frac{598800000}{x^{25}}$   
 $\frac{d^9y}{dx^9} = -\frac{5988000000}{x^{26}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{59880000000}{x^{27}}$

23.  $y = \frac{1}{x^{18}}$   
 $\frac{dy}{dx} = -\frac{18}{x^{19}}$   
 $\frac{d^2y}{dx^2} = \frac{1824}{x^{20}}$   
 $\frac{d^3y}{dx^3} = -\frac{7424}{x^{21}}$   
 $\frac{d^4y}{dx^4} = \frac{74240}{x^{22}}$   
 $\frac{d^5y}{dx^5} = -\frac{742400}{x^{23}}$   
 $\frac{d^6y}{dx^6} = \frac{7424000}{x^{24}}$   
 $\frac{d^7y}{dx^7} = -\frac{74240000}{x^{25}}$   
 $\frac{d^8y}{dx^8} = \frac{742400000}{x^{26}}$   
 $\frac{d^9y}{dx^9} = -\frac{7424000000}{x^{27}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{74240000000}{x^{28}}$

24.  $y = \frac{1}{x^{19}}$   
 $\frac{dy}{dx} = -\frac{19}{x^{20}}$   
 $\frac{d^2y}{dx^2} = \frac{2160}{x^{21}}$   
 $\frac{d^3y}{dx^3} = -\frac{9360}{x^{22}}$   
 $\frac{d^4y}{dx^4} = \frac{93600}{x^{23}}$   
 $\frac{d^5y}{dx^5} = -\frac{936000}{x^{24}}$   
 $\frac{d^6y}{dx^6} = \frac{9360000}{x^{25}}$   
 $\frac{d^7y}{dx^7} = -\frac{93600000}{x^{26}}$   
 $\frac{d^8y}{dx^8} = \frac{936000000}{x^{27}}$   
 $\frac{d^9y}{dx^9} = -\frac{9360000000}{x^{28}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{93600000000}{x^{29}}$

25.  $y = \frac{1}{x^{20}}$   
 $\frac{dy}{dx} = -\frac{20}{x^{21}}$   
 $\frac{d^2y}{dx^2} = \frac{2520}{x^{22}}$   
 $\frac{d^3y}{dx^3} = -\frac{11520}{x^{23}}$   
 $\frac{d^4y}{dx^4} = \frac{115200}{x^{24}}$   
 $\frac{d^5y}{dx^5} = -\frac{1152000}{x^{25}}$   
 $\frac{d^6y}{dx^6} = \frac{11520000}{x^{26}}$   
 $\frac{d^7y}{dx^7} = -\frac{115200000}{x^{27}}$   
 $\frac{d^8y}{dx^8} = \frac{1152000000}{x^{28}}$   
 $\frac{d^9y}{dx^9} = -\frac{11520000000}{x^{29}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{115200000000}{x^{30}}$

26.  $y = \frac{1}{x^{21}}$   
 $\frac{dy}{dx} = -\frac{21}{x^{22}}$   
 $\frac{d^2y}{dx^2} = \frac{3024}{x^{23}}$   
 $\frac{d^3y}{dx^3} = -\frac{13440}{x^{24}}$   
 $\frac{d^4y}{dx^4} = \frac{134400}{x^{25}}$   
 $\frac{d^5y}{dx^5} = -\frac{1344000}{x^{26}}$   
 $\frac{d^6y}{dx^6} = \frac{13440000}{x^{27}}$   
 $\frac{d^7y}{dx^7} = -\frac{134400000}{x^{28}}$   
 $\frac{d^8y}{dx^8} = \frac{1344000000}{x^{29}}$   
 $\frac{d^9y}{dx^9} = -\frac{13440000000}{x^{30}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{134400000000}{x^{31}}$

27.  $y = \frac{1}{x^{22}}$   
 $\frac{dy}{dx} = -\frac{22}{x^{23}}$   
 $\frac{d^2y}{dx^2} = \frac{3696}{x^{24}}$   
 $\frac{d^3y}{dx^3} = -\frac{16128}{x^{25}}$   
 $\frac{d^4y}{dx^4} = \frac{161280}{x^{26}}$   
 $\frac{d^5y}{dx^5} = -\frac{1612800}{x^{27}}$   
 $\frac{d^6y}{dx^6} = \frac{16128000}{x^{28}}$   
 $\frac{d^7y}{dx^7} = -\frac{161280000}{x^{29}}$   
 $\frac{d^8y}{dx^8} = \frac{1612800000}{x^{30}}$   
 $\frac{d^9y}{dx^9} = -\frac{16128000000}{x^{31}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{161280000000}{x^{32}}$

28.  $y = \frac{1}{x^{23}}$   
 $\frac{dy}{dx} = -\frac{23}{x^{24}}$   
 $\frac{d^2y}{dx^2} = \frac{4464}{x^{25}}$   
 $\frac{d^3y}{dx^3} = -\frac{19360}{x^{26}}$   
 $\frac{d^4y}{dx^4} = \frac{193600}{x^{27}}$   
 $\frac{d^5y}{dx^5} = -\frac{1936000}{x^{28}}$   
 $\frac{d^6y}{dx^6} = \frac{19360000}{x^{29}}$   
 $\frac{d^7y}{dx^7} = -\frac{193600000}{x^{30}}$   
 $\frac{d^8y}{dx^8} = \frac{1936000000}{x^{31}}$   
 $\frac{d^9y}{dx^9} = -\frac{19360000000}{x^{32}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{193600000000}{x^{33}}$

29.  $y = \frac{1}{x^{24}}$   
 $\frac{dy}{dx} = -\frac{24}{x^{25}}$   
 $\frac{d^2y}{dx^2} = \frac{5292}{x^{26}}$   
 $\frac{d^3y}{dx^3} = -\frac{22224}{x^{27}}$   
 $\frac{d^4y}{dx^4} = \frac{222240}{x^{28}}$   
 $\frac{d^5y}{dx^5} = -\frac{2222400}{x^{29}}$   
 $\frac{d^6y}{dx^6} = \frac{22224000}{x^{30}}$   
 $\frac{d^7y}{dx^7} = -\frac{222240000}{x^{31}}$   
 $\frac{d^8y}{dx^8} = \frac{2222400000}{x^{32}}$   
 $\frac{d^9y}{dx^9} = -\frac{22224000000}{x^{33}}$   
 $\frac{d^{10}y}{dx^{10}} = \frac{222240000000}{x^{34}}$

30.  $y = \frac{1}{$



$$\begin{aligned}
 & \text{(4) } \frac{d}{dt} \sin t = \cos t \cdot \frac{d}{dt} t \\
 & \text{Let } u = \sin t, \quad du = \cos t dt \\
 & \int \frac{\sin^2 t}{\cos^2 t} dt = \int u du = u^2 + C = \frac{1}{\cos^2 t} + C + 6 \\
 & \text{(5) Let } x = 3 \tan t \quad \text{dax 3tanatid.} \quad \frac{dx}{dt} = 3 \sec^2 t \\
 & \frac{dx}{dt} = 3 \sqrt{1 + \tan^2 t} \cdot \frac{d}{dt} \tan t = 3 \sqrt{1 + x^2} dx \\
 & \int \frac{dx}{x \sqrt{1+x^2}} = \int \frac{3 \sec^2 t}{3 \tan t} dt = \int \frac{1}{\tan t} dt \\
 & = \int \frac{1}{\tan t} \cdot \frac{\cos t}{\cos t} dt \\
 & = \int \frac{\cos t}{\sin t} dt = \int \frac{1}{\sin t} d(\sin t) \\
 & = -\ln|\csc t + \cot t| + C \\
 & \text{Let } x = 3 \tan t \Rightarrow \tan t = \frac{x}{3} \Rightarrow \csc^2 t = 1 + \frac{x^2}{9} \Rightarrow \csc t = \sqrt{1 + \frac{x^2}{9}} \\
 & \text{So } -\ln\left|\csc t + \cot t\right| + C = -\ln\left|\sqrt{1 + \frac{x^2}{9}} + \frac{1}{3}\right| + C
 \end{aligned}$$



(1) (b)  $\int_{\text{unendlich}}^{\infty} \frac{1}{x^2} dx = \lim_{b \rightarrow \infty} \int_1^b \frac{1}{x^2} dx = \lim_{b \rightarrow \infty} \left[ -\frac{1}{x} \right]_1^b = \lim_{b \rightarrow \infty} \left( -\frac{1}{b} + 1 \right) = 1$

(2)  $\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$   
 $\int_{-\infty}^{\infty} x e^{-x^2} dx = 0$

(3)  $\int_{-\infty}^{\infty} x^2 e^{-x^2} dx = \sqrt{\pi}$

(4)  $\int_{-\infty}^{\infty} x^3 e^{-x^2} dx = 0$

(5)  $\int_{-\infty}^{\infty} x^4 e^{-x^2} dx = \frac{3}{4}\sqrt{\pi}$

(6)  $\int_{-\infty}^{\infty} x^5 e^{-x^2} dx = 0$

(7)  $\int_{-\infty}^{\infty} x^6 e^{-x^2} dx = \frac{15}{16}\sqrt{\pi}$

(8)  $\int_{-\infty}^{\infty} x^7 e^{-x^2} dx = 0$

(9)  $\int_{-\infty}^{\infty} x^8 e^{-x^2} dx = \frac{35}{32}\sqrt{\pi}$

(10)  $\int_{-\infty}^{\infty} x^9 e^{-x^2} dx = 0$

(11)  $\int_{-\infty}^{\infty} x^{10} e^{-x^2} dx = \frac{315}{128}\sqrt{\pi}$

(12)  $\int_{-\infty}^{\infty} x^{11} e^{-x^2} dx = 0$

(13)  $\int_{-\infty}^{\infty} x^{12} e^{-x^2} dx = \frac{3465}{1024}\sqrt{\pi}$

(14)  $\int_{-\infty}^{\infty} x^{13} e^{-x^2} dx = 0$

(15)  $\int_{-\infty}^{\infty} x^{14} e^{-x^2} dx = \frac{3465}{512}\sqrt{\pi}$

(16)  $\int_{-\infty}^{\infty} x^{15} e^{-x^2} dx = 0$

(17)  $\int_{-\infty}^{\infty} x^{16} e^{-x^2} dx = \frac{3465}{256}\sqrt{\pi}$

(18)  $\int_{-\infty}^{\infty} x^{17} e^{-x^2} dx = 0$

(19)  $\int_{-\infty}^{\infty} x^{18} e^{-x^2} dx = \frac{3465}{128}\sqrt{\pi}$

(20)  $\int_{-\infty}^{\infty} x^{19} e^{-x^2} dx = 0$

(21)  $\int_{-\infty}^{\infty} x^{20} e^{-x^2} dx = \frac{3465}{64}\sqrt{\pi}$

(22)  $\int_{-\infty}^{\infty} x^{21} e^{-x^2} dx = 0$

(23)  $\int_{-\infty}^{\infty} x^{22} e^{-x^2} dx = \frac{3465}{32}\sqrt{\pi}$

(24)  $\int_{-\infty}^{\infty} x^{23} e^{-x^2} dx = 0$

(25)  $\int_{-\infty}^{\infty} x^{24} e^{-x^2} dx = \frac{3465}{16}\sqrt{\pi}$

(26)  $\int_{-\infty}^{\infty} x^{25} e^{-x^2} dx = 0$

(27)  $\int_{-\infty}^{\infty} x^{26} e^{-x^2} dx = \frac{3465}{8}\sqrt{\pi}$

(28)  $\int_{-\infty}^{\infty} x^{27} e^{-x^2} dx = 0$

(29)  $\int_{-\infty}^{\infty} x^{28} e^{-x^2} dx = \frac{3465}{4}\sqrt{\pi}$

(30)  $\int_{-\infty}^{\infty} x^{29} e^{-x^2} dx = 0$

(31)  $\int_{-\infty}^{\infty} x^{30} e^{-x^2} dx = \frac{3465}{2}\sqrt{\pi}$

(32)  $\int_{-\infty}^{\infty} x^{31} e^{-x^2} dx = 0$

(33)  $\int_{-\infty}^{\infty} x^{32} e^{-x^2} dx = \frac{3465}{1}\sqrt{\pi}$

(34)  $\int_{-\infty}^{\infty} x^{33} e^{-x^2} dx = 0$

(35)  $\int_{-\infty}^{\infty} x^{34} e^{-x^2} dx = \frac{3465}{0}\sqrt{\pi}$

$$\begin{aligned}
 & \text{(7) } \text{if } f(p) = -\frac{1}{2}p^2 + 7p \\
 & f(3) = -12 \\
 & \text{f}(x) = -\frac{1}{2}x^2 + 7x \\
 & g(x) = 3x - \frac{10}{x+5} \\
 & g(3) = 3 \times \frac{10}{3+5} = -\frac{30}{8} = -\frac{15}{4} \\
 & p+3 = -\frac{15}{4} + 7 = \frac{13}{4} \\
 & \text{if } f(p) = -\frac{1}{2}p^2 + 7p \\
 & p = 7 \Rightarrow p = 7 \\
 & \text{if } f(p) = -\frac{1}{2}p^2 + 7p \\
 & p = 7 \Rightarrow p = 7 \\
 & \text{if } f(p) = -\frac{1}{2}p^2 + 7p \\
 & p = 7 \Rightarrow p = 7 \\
 & \text{if } f(p) = -\frac{1}{2}p^2 + 7p \\
 & p = 7 \Rightarrow p = 7
 \end{aligned}$$

1. (1)  $\int x^4 \, dx$  ✓ (2)  $\int \sin x \, dx$  ✓ (3)  $\int t^2 \, dt$  ✓  
 1. (4)  $\int \cos x \, dx$  ✓

3. - (1)  $\int f(x) \, dx = \frac{1 + (\ln x)^2}{x \ln x} + C = \frac{1 + \frac{2(\ln x)^2}{1 + (\ln x)^2}}{x + (\ln x)^2} + C = \frac{1 + \frac{2(\ln x)^2 + x}{1 + (\ln x)^2}}{x(1 + (\ln x)^2)} = \frac{1 + 2(\ln x)^2 + x}{x(1 + (\ln x)^2)}$   
 (2)  $f(x) = -\frac{1}{2}(1 + x^2)^{-\frac{1}{2}} \cdot 2x = -x(1 + x^2)^{-\frac{1}{2}}$  ✓

4.  $f(x) = 1$   
 $f'(x) = e^{-x}$  →  $f(x) = -e^{-x} + C$   
 $f(x) = -1 + e^{-x} + C$   
 $f(x) = e^{-x} + C$  ✓

2. (1)  $\int -5x^3 \, dx = -\frac{5}{4}x^4 + C = -\frac{5}{4}x^4 + C$  ✓  
 (2)  $\int (-6x+3)\ln(3x) \, dx = -6x\ln(3x) + 3\ln(3x) + C$  ✓

(9)  $\int \frac{1}{x+1} \, dx = \ln|x+1| + C$  ✓  
 (10)  $\int \tan^2 x + \cot^2 x \, dx = \frac{1}{2} \int \tan^2 x + \cot^2 x \, d(\tan x) + C = -\frac{1}{2} \ln|\tan(\tan x)| + C$

(11)  $\int \frac{x^2}{e^x + e} \, dx = \int \frac{e^x}{e^{x+1}} \, dx = \int \frac{1}{e^{x+1}} \, dx = \arctan e^x + C$

(12)  $\int \frac{1}{\sqrt{2-x^2}} \, dx = \frac{1}{\sqrt{2}} \int \frac{1}{\sqrt{1-\frac{x^2}{2}}} \, d(\frac{x}{\sqrt{2}}) = \frac{1}{\sqrt{2}} \arctan \frac{x}{\sqrt{2}} + C = \frac{\pi}{4} \arctan \frac{x}{\sqrt{2}} + C$

(13)  $\int \frac{1}{1-x^2} \, dx = -\frac{1}{2} \ln|1-x^2| + C$

(14)  $\int \cos x \sin x \, dx = -\int \cos x \, d(\cos x) = -\frac{1}{2} \frac{d(\cos x)}{\cos x} = -\frac{1}{2} \frac{-\sin x}{\cos x} + C = \frac{1}{2} \frac{\sin x}{\cos x} + C = \frac{1}{2} \tan x + C$

(15)  $\int \int \frac{1}{1+x^2} \, d(x+2)$   
 $= \int \frac{1}{1+(x+2)^2} \, d(x+2)$



$$\begin{aligned} \text{(7) } x &= \tan t \in (-\frac{\pi}{2}, \frac{\pi}{2}) \text{ dois casos} \\ &\int \frac{\cos^2 t}{\sin t} dt = \int \frac{(\sin^2 t)^{-1} - \sin t}{\sin t} dt \\ &= \frac{1}{2} \int (\sin^{-2} t + \sin t) dt = \frac{1}{2} \left( \frac{1}{\sin t} - \frac{1}{2} \sin^2 t \right) + C \\ \text{(8) } x &= \sec t \in (-\frac{\pi}{2}, \frac{\pi}{2}) \text{ dois casos} \\ &\int \frac{\sec t}{\tan t} dt = \int \frac{1 - \tan^2 t}{\tan t} dt \\ &= t - \int \frac{\tan^2 t}{\tan t} dt \\ &= t - \int \frac{\tan t}{\tan^2 t} dt \\ &= t - \tan^{-1} t + C \\ &+ \arctan \frac{1}{x} + C \end{aligned}$$



$$\begin{aligned} \text{(1) } & \int e^{ax} dx = x - \int \ln(e^{ax}) dx = x - ax + C \\ \text{(2) } & \int e^{ax^2} dx = -\frac{1}{a} \int e^{-ax^2} (-2ax) dx = -\frac{1}{a} (e^{-ax^2}) + C \\ \text{(3) } & \text{First term: } \int e^{ax} dx = ax + C \\ & \text{Second term: } \int \frac{e^{ax}}{x} dx = \text{Integration by parts: } u = \frac{1}{x}, dv = e^{ax} dx \\ & \quad v = e^{ax}, du = -\frac{1}{x^2} dx \\ \text{(4) } & \int e^{ax} dx = e^{ax} - \int \ln(e^{ax}) dx = e^{ax} - \int e^{ax} dx \\ & \quad \text{Let } u = e^{ax}, du = a e^{ax} dx \\ & \quad \int e^{ax} dx = e^{ax} - \int \ln(u) \frac{du}{a} \\ & \quad = e^{ax} - \frac{1}{a} \ln(e^{ax}) + C \\ & \Rightarrow \boxed{\int e^{ax} dx = e^{ax} - \frac{1}{a} \ln(e^{ax}) + C} \\ \text{(5) } & \int e^{ax} \sin(bx) dx = -\frac{1}{b} \left[ e^{ax} \cos(bx) - \int e^{ax} (-b \sin(bx)) dx \right] \\ & \quad = -\frac{1}{b} (e^{ax} \cos(bx) + e^{ax} \frac{\sin(bx)}{b}) + C \\ & \quad = -\frac{1}{b} e^{ax} (\cos(bx) + \frac{\sin(bx)}{b}) + C \end{aligned}$$



$$\begin{aligned}
 (1) & \int_{\frac{\pi}{2}}^{\pi} (\ln x)^2 dx = -x^2 \ln x \Big|_{\frac{\pi}{2}}^{\pi} + \int_{\frac{\pi}{2}}^{\pi} x^2 d(\ln x) \\
 &= -\pi^2 \ln \pi + \frac{1}{2} \int_{\frac{\pi}{2}}^{\pi} x^2 dx + \int_{\frac{\pi}{2}}^{\pi} x^2 d(\ln x) \\
 &= -\pi^2 \ln \pi + \frac{1}{4} \pi^4 - \frac{1}{2} \int_{\frac{\pi}{2}}^{\pi} x^2 \ln x + C. \\
 (2) & \int_0^{\pi} x^2 \cos x dx = \left[ x^2 \sin x \right]_0^{\pi} - \int_0^{\pi} 2x \sin x dx + \int_0^{\pi} x^2 d(\sin x) \\
 &= \left[ x^2 \sin x \right]_0^{\pi} + 2x \cos x \Big|_0^{\pi} - \int_0^{\pi} x^2 \cos x dx \\
 &= \left[ x^2 \sin x \right]_0^{\pi} + 2x \cos x \Big|_0^{\pi} + \int_0^{\pi} x^2 \cos x dx \\
 &\Rightarrow -2 \int_0^{\pi} x^2 \cos x dx = \left[ x^2 \sin x \right]_0^{\pi} + 2x \cos x \Big|_0^{\pi} \\
 (3) & \int_0^{\pi} \ln x \sin x dx = -x \ln x \Big|_0^{\pi} + \int_0^{\pi} x dx \\
 &= -x \ln x \Big|_0^{\pi} + \int_0^{\pi} \frac{x \ln x}{x} dx \\
 &= -x \ln x \Big|_0^{\pi} + \int_0^{\pi} \frac{1}{x} \ln x dx + \int_0^{\pi} x d(\ln x) \\
 &= -x \ln x \Big|_0^{\pi} + \int_0^{\pi} \frac{1}{x} \ln x dx \\
 &\Rightarrow -2 \int_0^{\pi} \ln x \sin x dx = -x \ln x \Big|_0^{\pi} + \int_0^{\pi} \frac{1}{x} \ln x dx + C
 \end{aligned}$$