

Self-study, week 4

1. Determine the derivatives of

1.1 $f(x) = (x + 1)^5$

1.2 $g(x) = (2x + 1)^5$

1.3 $h(x) = (2 \sin(x) + 1)^5$

1.4 $q(x) = (2 \sin(x^2) + 1)^5$

1.5 $p(x) = \frac{1}{\ln(x)}, x > 0$

1.6 $s(x) = \frac{x^2}{\ln(x)}, x > 0$

1.7 $k(x) = e^{3x^7}$

1.8 $r(x) = e^{(\cos(x))^2}$

2. Determine the anti-derivatives of

2.1 $f(x) = (x + 1)^5$

2.2 $g(x) = (2x + 1)^5$

2.3 $h(x) = \cos(7x)$

2.4 $p(x) = 3e^{24x}$.

2.5 $q(x) = 7e^{x/7} + \sin(4x)$.

2.6 $r(x) = \frac{1}{2x+1}$.

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3. Draw the slope field of $y' = x - xy$. Use this to sketch the solution passing through $(1, 0)$. You may achieve a clear figure using about 25 grid points (x_i, y_i) with $-2 \leq x_i, y_i \leq 2$.
4. Show that by defining $z(x) = \frac{1}{y(x)}$ the differential equation

$$y' = 4y^2 + y,$$

can be written as a linear differential equation in the function z .

Use this to solve the original differential equation.

5. Solve the differential equation

$$y' + \frac{1}{(x+1)}y = \frac{x}{(x+1)}, \quad x > -1.$$