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Quiz 2

This quiz is graded out of 10 marks. No books, calculators, notes or cell phones are allowed. You must show all your work, the correct answer is worth 1 mark the remaining marks are given for the work. If you need more space for your answer use the back of the page.

Question 1. *(1 mark each)* ~~Differentiate~~ Integrate the following functions:

a.

$$\int \frac{1}{x^{2/5}}\,dx = \int x^{-2/5}\,dx = \frac{x^{3/5}}{3/5} + C = \frac{5}{3}x^{3/5} + C$$

b.

$$\int \sec x\,dx = \ln|\sec x + \tan x| + C$$

c.

$$\int \cot x\,dx = \ln|\sin x| + C$$

d.

$$\int \frac{1}{x\sqrt{x^2-5}}\,dx = \frac{1}{\sqrt{5}}\operatorname{arcsec}\left(\frac{x}{\sqrt{5}}\right) + C$$

e.

$$\int \frac{1}{\sqrt{\pi - x^2}}\,dx = \arcsin\left(\frac{x}{\sqrt{\pi}}\right) + C$$

f.

$$\int \sin x\,dx = -\cos x + C$$

Question 2. *(4 marks)* §4.7 #30 Find a function f such that $f'(x) = x^3$ and the line $x + y = 0$ is tangent to the graph of f.

$$f(x) = \int f'(x)\,dx = \int x^3\,dx = \frac{x^4}{4} + C$$

The slope of the tangent is -1. $f(x)$ has a tangent of slope -1 when

$$-1 = f'(x)$$
$$-1 = x^3$$
$$-1 = x$$

The tangent at $x = -1$ is $-1 + y = 0$, $y = 1$.

and intersects the function. Hence the initial condition is $f(-1) = 1$

$$1 = \frac{(-1)^4}{4} + C$$

$$\frac{3}{4} = C$$

$$\therefore f(x) = \frac{x^4}{4} + \frac{3}{4}$$