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Foundation Calculus & Mathematical Techniques (CELEN037)

Sample Exam Answers

1) This is a proof question the final answer is already given

2) $$\frac{dy}{dx} = \left(\frac{x^2-1}{x^2}\right)\ln(x) + \frac{x^2+1}{x^2}$$

3) This is a proof question the final answer is already given

4) $$\frac{dy}{dx} = -3\sin(3x+2)e^{\cos(3x+2)}$$

5) $$\frac{dy}{dx} = \frac{2}{7}$$

6) $$\frac{dy}{dx} = \left[6\cot(2x) - \frac{1}{5x} - \frac{\sec^2(x)}{\tan(x)}\right]\frac{\sin^3(2x)}{\sqrt[5]{x}\tan(x)}$$

7) $$\frac{dy}{dx} = \frac{b}{a}\left[\frac{1}{2\sin(2\theta)} + \cot(2\theta)\right]$$

8) Tangent line: $2y + 5x - 10 = 0$

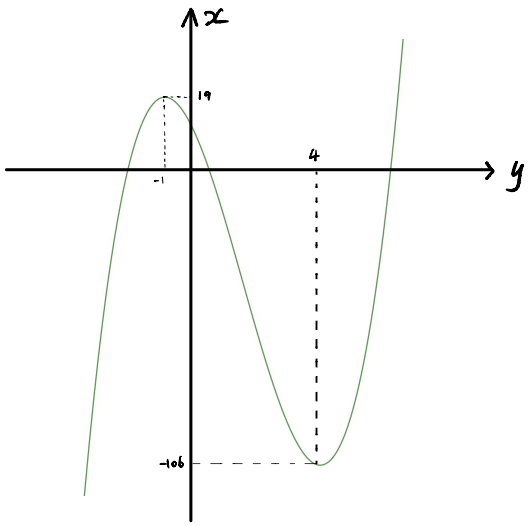
9) Minimum at $(4, -106)$ and $(-1, 19)$

10)

11) $$\frac{dh}{dt} = 250\sqrt{3}\,km/h$$

12) $$\frac{dy}{dx} = \sec^2(x) \qquad \frac{d^2y}{dx^2} = 2\sec^2(x)\tan(x) \qquad \frac{d^3y}{dx^3} = 4\sec^2(x)\tan^2(x) + 2\sec^4(x)$$

13) $$\ln(1-x) = -x - \frac{x^2}{2} - \frac{x^3}{3} - \frac{x^4}{4} - \cdots \qquad \ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots$$



14) $x = 1.4422496$ to $7d.p.$

15) $$\int \frac{x^4 - 27x}{3 - x} dx = -\frac{x^4}{4} - x^3 - \frac{9}{2}x^2 + C$$

16) $$\int \frac{\sin(3x)}{[1 + 2\cos(3x)]^3} dx = \frac{1}{12\,[1 + 2\cos(3x)]^2} + C$$

17) $$\int \frac{\cos(x)}{\sqrt[3]{4 + \sin(x)}} dx = \frac{3}{2}\,[4 + \sin(x)]^{\frac{2}{3}} + C$$

18) $$\int \frac{1}{\sqrt{4x^2 + 4x + 3}} dx = \frac{1}{2} \ln \left| \left(x + \frac{1}{2}\right) + \sqrt{x^2 + x + \frac{3}{4}} \right| + C$$

19) $$\int \sin^8(x) \cos^3(x) dx = \frac{\sin^9(x)}{9} - \frac{\sin^{11}(x)}{11} + C$$

20) $$\int \cos(7x) \cos(3x) dx = \frac{1}{2} \left[\frac{\sin(10x)}{10} + \frac{\sin(4x)}{4} \right] + C$$