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Problem OCW

Q1 $\frac{x}{x^2+1}$

If we approach this function, we see that can never be undefined since it doesn't give a chance to eliminate the 1 by being a square, a positive number.

→ So there are no discontinuities.

Q2 $\frac{1}{\sqrt{x}}$

→ We see that as we keep,

$$\cancel{f(0)} = \lim_{x \to 0^+} \left(\frac{1}{\sqrt{x}}\right) = +\infty$$

because negative values are unacceptable since it would be in the complex plane, so there exists only the right side.

So $x=0$

→ 0 is undefined for the function.

QB of Limits

$$\lim_{x \to 0} \frac{\sin x}{3\sqrt{x}}$$

$$= \lim_{x \to 0} \frac{\sin x \sqrt{x}}{x \; 3}$$

$$= \lim_{x \to 0} \frac{\sin x}{x} \times \frac{\sqrt{x}}{3}$$

$$= \lim \; 1 \times \frac{0}{3}$$

$$= \underline{\underline{0}}$$

Q5

$$\lim_{x \to 0} \frac{3x^2 + \sin x}{x}$$

$$\lim_{x \to 0} 3x + \frac{\sin x}{x}$$

$$\cancel{\lim_{x \to 0}} \; 3 \cdot 3(0) + 1$$

$$= \underline{\underline{1}}$$

Q6 $\cancel{y} = \cancel{Tan}$

$$y = 6x^3 + 5x - 3$$

$$\frac{dy}{dx} = 18x^2 + 5$$

→ Equating to 4,

$$4 = 18x^2 + 5$$

$$\boxed{\frac{-1}{18} = x^2}$$

→ Square can't be -ve so no tangent possible.

Q7 Differentiate

$$\sqrt{t} - \frac{1}{\sqrt{t}}$$

$$\frac{t-1}{\sqrt{t}}$$

$$\frac{dy}{dx} = \frac{d}{dt}\left(\frac{t-1}{\sqrt{t}}\right) = \frac{\sqrt{t}(1) - (t-1)\frac{1}{2\sqrt{t}}}{t}$$

$$= \frac{2t - t + 1}{t \times 2\sqrt{t}} = \boxed{\frac{t+1}{2t\sqrt{t}}}$$

Q8 $\frac{x^2 - 2\sqrt{x}}{x} = y$

$$y = x - 2x^{\frac{1}{2}-1}$$

$$y = x - 2x^{-\frac{1}{2}}$$

$$\frac{dy}{dx} = 1 + x^{\frac{-3}{2}}$$

$$= 1 + \frac{1}{\sqrt{x^3}}$$

$$= \boxed{\frac{\sqrt{x^3} + 1}{\sqrt{x^3}}}$$

Q9

$$y = x\sqrt{x} - \sqrt{x}$$

$$y = x^{\frac{3}{2}} - x^{\frac{1}{2}}$$

$$\frac{dy}{dx} = \frac{3}{2}x^{\frac{1}{2}} - \frac{1}{x^{\frac{1}{2}}}$$

$$= \boxed{\frac{3x-2}{2\sqrt{x}}}$$