Quiz #2 Study Guide

(1) $ac = (7)(3) = 21 = tu \quad b = 22 = t+u \quad t = 21 \quad u = 1$

$7x^2+22x+3 = 7x^2+21x+x+3 = 7x(x+3)+1\cdot(x+3) = (7x+1)(x+3)$

$f(x) = \dfrac{(7x+1)(x+3)}{(7x+1)} \Rightarrow$ hole at $x = -\frac{1}{7}$

(2) Oscillatory discontinuities at $x=-5$ and $x=5$

(3) Graph $y=f(x) \Rightarrow$ Jump discontinuity at $x=3$

(4) $ac = (2)(-21) = -42 = tu \quad b = 11 = t+u \quad t = 14 \quad u = -3$

$2x^2+11x-21 = 2x^2+14x-3x-21 = 2x(x+7)-3(x+7) = (2x-3)(x+7)$

$f(x) = \dfrac{x+8}{(2x-3)(x+7)} \Rightarrow$ infinite discontinuities at $x=\frac{3}{2}$ and $x=-7$

(5)

$$\begin{array}{r} x-2 \\ 3x+8 \overline{)\,3x^2+2x-16} \\ -3x^2-8x \\ \hline -6x-16 \\ 6x+16 \\ \hline 0 \end{array}$$

$f(x) = x-2$

(6)(a) $f(1) = -1 \quad f(5) = 7 \Rightarrow f(1) < f(c) < f(5)$ so IVTLF applies

(b) $4 = c^2-4c+2, \quad c^2-4c-2=0, \quad c = \dfrac{4 \pm \sqrt{4^2-4(1)(-2)}}{2(1)} = \dfrac{4 \pm \sqrt{24}}{2} = \dfrac{4 \pm 2\sqrt{6}}{2}$

$c = 2 \pm \sqrt{6} \quad c = 2+\sqrt{6} \approx 4.449$ ✓

$c = 2-\sqrt{6} = -0.449$ ✗ not in $(1,5)$

(7) $f(x) = x^2-4x+2$ is continuous $\Rightarrow \lim_{x \to 3} f(x) = f(3) = -1$

(8)(a) $f(3+h) = 3(3+h)^2-4(3+h)+7 = 3(9+6h+h^2)-4(3+h)+7 = 27+18h+3h^2-12-4h+7 =$

$= 22+14h+3h^2, \quad f(3+h)-f(3) = 14h+3h^2, \quad \dfrac{f(3+h)-f(3)}{h} = 14+3h$

$m_{f(3)}(3) = \lim_{h \to 0} \dfrac{f(3+h)-f(3)}{h} = 14$

(b) $y = 14x+b, \quad 22 = 14(3)+b, \quad b = -20, \quad y = 14x-20$

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(9) $f(x+h) = 5(x+h)^2 + 14(x+h) + 13 = 5(x^2+2xh+h^2) - 14(x+h) + 13 =$

$= 5x^2 + 10xh + 5h^2 - 14x - 14h + 13 = \underbrace{5x^2 - 14x + 13}_{f(x)} + (10x - 14)h + 5h^2$

$f(x+h) - f(x) = (10x - 14)h + 5h^2 \qquad \frac{f(x+h) - f(x)}{h} = 10x - 14 + 5h$

$m_T(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = 10x - 14 = 0 \Rightarrow x = \frac{7}{5}$

(10) $y(t+h) = -16(t+h)^2 + 125(t+h) = -16(t^2+2th+h^2) + 125(t+h) =$

$= -16t^2 - 32th - 16h^2 + 125t + 125h = \underbrace{-16t^2 + 125t}_{y(t)} + (-32t + 125)h - 16h^2$

$y(t+h) - y(t) = (-32t + 125)h - 16h^2$

$\frac{y(t+h) - y(t)}{h} = -32t + 125 - 16h \qquad V = \lim_{h \to 0} \frac{y(t+h) - y(t)}{h} = -32t + 125$

$50 = -16t^2 + 125t, \quad 16t^2 - 125t + 50 = 0, \quad t = \frac{125 \pm \sqrt{125^2 - 4(16)(50)}}{2(16)}$

$t = \frac{125 \pm \sqrt{12,425}}{32}$ $\qquad t = 7.390$ sec ✓

$t = 0.423$ sec ✗ ball on way up

$V(7.390) = -32(7.390) + 125 = -111.47 \frac{ft}{sec}$, speed $= 111.47 \frac{ft}{sec}$