Solutions: Test #1, 1K03E

Multiple choice answers: *(One mark each)*

1. d) 2. b) 3. e) 4. a) 5. e) 6. c) 7. b) 8. b)

Long Answers: *(Three marks each)*

9. part a)

Given that $y = x^3 - 5x + 6 = f(x)$, we know $y' = \frac{d}{dx}x^3 - 5\frac{d}{dx}x + \frac{d}{dx}(6)$

(1 mark) $= 3x^{3-1} - 5\bullet 1 + 0 = 3x^2 - 5$

At the point where $x_0 = 1$, we have $y_0 = f(x_0) = (1)^3 - 5\bullet 1 + 6 = 2$
and as always, $m = f'(x_0) = f'(1) = 3 - 5 = -2$ *(1 mark)*

Putting this into the equation of a line:

$$y - y_0 = m(x - x_0) \Rightarrow y - 2 = (-2)(x - 1) = -2x + 2$$
$$\Rightarrow y = -2x + 4$$ *(1 mark)*

10. part a) *(1.5 mark)*

$$\lim_{x\to 0} g(x) = \lim_{x\to 0}\frac{x}{x^2 - x} = \lim_{x\to 0}\frac{x}{(x-1)x} = \lim_{x\to 0}\frac{1}{(x-1)} = \frac{1}{(0-1)} = -1$$

Since we have found $\lim_{x\to 2} g(x) = -1$, we know that $\lim_{x\to 2^-} g(x) = -1 = \lim_{x\to 2^+} g(x)$ as well.

part b) *(1 mark)*

As a rational function, g(x) is discontinuous only when the denominator is zero.
Thus $g(x)$ is continuous for all real $x \neq 0,1$

part c) *(0.5 mark)*

We've shown in **a)** that $\lim_{x\to 0} g(x) = -1$

Since now we have assigned $g(0) = -1$, we know that $\lim_{x\to 0} g(x) = -1 = g(x)$.

Thus by definition, our new $g(x)$ is continuous at $x = 0$.

Total: 14 marks