MATH 141: Quiz 7

Name: Key

Directions:

- Show your thought process (commonly said as "show your work") when solving each problem for full credit. **Remember to fully simplify.**
- If you do not know how to solve a problem, try your best and/or explain in English what you would do.
- Good luck!

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1. Given

$$f''(x) = 20x^3 + 12x^2 + 4, \qquad f(0) = 8, \qquad f(1) = 5$$

Find the function $f(x)$.

Use general antiderivatives.

$$f'(x) = 20 \cdot \frac{x^4}{4} + 12\frac{x^3}{3} + 4x + C$$

$$= 5x^4 + 4x^3 + 4x + C$$

$$f(x) = 5\frac{x^5}{5} + 4\frac{x^4}{4} + 4\frac{x^2}{2} + Cx + D$$

$$= x^5 + x^4 + 2x^2 + Cx + D$$

Use initial conditions to find C and D

$$8 = f(0) = 0^5 + 0^4 + 2\cdot 0^2 + C\cdot 0 + D$$

So $D = 8$. Substitute in.

$$5 = f(1) = 1^5 + 1^4 + 2\cdot 1^2 + C\cdot 1 + 8$$

$$5 = 12 + C \rightarrow C = -7$$

$$\boxed{f(x) = x^5 + x^4 + 2x^2 - 7x + 8}$$

2. Integrate the following

(a) $\int_{-2}^{21} 3\,dx = 3x \Big|_{-2}^{21} = 3\cdot 21 - 3\cdot(-2) = \boxed{69}$

(b) $\int_{1}^{3} (x+1)\,dx = \frac{x^2}{2} + x \Big|_{1}^{3} = \frac{3^2}{2} + 3 - \left(\frac{1^2}{2} + 1\right)$

$= \frac{9}{2} + 3 - \frac{3}{2}$

$= \boxed{6}$

(c) $\int_{-2}^{2} (4x^3 - x^2 + 1)\,dx = 4\frac{x^4}{4} - \frac{x^3}{3} + x \Big|_{-2}^{2}$

$= x^4 - \frac{x^3}{3} + x \Big|_{-2}^{2}$

$= 2^4 - \frac{2^3}{3} + 2 - \left((-2)^4 - \frac{(-2)^3}{3} - 2\right)$

$= 18 - \frac{8}{3} - \left(14 + \frac{8}{3}\right)$

$= 4 - \frac{16}{3}$

$= \boxed{-\frac{4}{3}}$