Spring 2019 Final Exam Answers

1. a) d,   b) $-1, \frac{-1}{3}, \frac{1}{3}, 1$

2. h

3. a) x=3, jump and x=4, removable
b) x=6
c) DNE
d) -1

4.

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \to 0} \frac{\frac{3}{2}(x+h)^2 + 5(x+h) - \left[\frac{3}{2}x^2 + 5x\right]}{h}$$

$$= \lim_{h \to 0} \frac{\frac{3}{2}(\cancel{x^2} + 2xh + h^2) + \cancel{5x} + 5h - \cancel{\frac{3}{2}x^2} - \cancel{5x}}{h}$$

$$= \lim_{h \to 0} \frac{3xh + \frac{3}{2}h^2 + 5h}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{h}(3x + \frac{3}{2}h + 5)}{\cancel{h}} = \boxed{3x+5}$$

5.

$$\boxed{f'(x) = \frac{-e^{\frac{1}{x}}}{x^2} + \frac{1}{2\sqrt{x}(1+x)} + 4^x \ln 4 - 6x^5 + \frac{1}{2x}}$$

6.

$$\boxed{\begin{array}{l} (2, 20) \\ (-2, -20) \end{array}}$$

7. d

8.

Find the open interval(s) where $f(x)$ is increasing and the intervals where $f(x)$ is decreasing.

$\boxed{(-1, 1) \cup (3, \infty)}$ f is $\boxed{\text{increasing}}$ since $f' > 0$

$\boxed{(-\infty, -1) \cup (1, 3)}$ f is $\boxed{\text{decreasing}}$ since $f' < 0$

Find and classify the critical point(s).

$\boxed{@\, x = 1}$ $f'$ changes from + to − $\Rightarrow$ $\boxed{\text{local max.}}$

$\boxed{@\, x = 3}$ $f'$ changes from − to + $\Rightarrow$ $\boxed{\text{local min.}}$

Find the interval(s) where the $f(x)$ is concave up and where the $f(x)$ is concave down.

$(-\infty, -2) \cup (2, \infty)$ f is concave up since $f'$ is increasing

$(-2, -1) \cup (-1, 2)$ f is concave down since $f'$ is decreasing

9.

$$\boxed{\begin{array}{ll} x = -3 & + \; - \Rightarrow \text{local max.} \\ x = 1 & - \; + \Rightarrow \text{local min.} \end{array}}$$

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10.

$(-\infty, -1)$ the function is concave down
$(-1, \infty)$ the function is concave up

11. (1,1)

12. f

13.

$$\boxed{f(x) = 3x^{5/3} - 2x^4 + \pi x + 2\tan x - \frac{1}{x} + 3\cos(4x)}$$

14. F