1. f(x) + f '(x)dx = $\sqrt{x}+\frac{1}{2\sqrt{x}}$ dx

(A) $5+(\frac{1}{10})(\frac{1}{2})=\boxed{\frac{101}{20}}$

(B) $7+(\frac{1}{14})(\frac{3}{5})=\boxed{\frac{493}{70}}$

(C) $9+(\frac{1}{18})(\frac{3}{4})=9+\frac{1}{24}=\boxed{\frac{217}{24}}$

(D) $10+(\frac{1}{20})(\frac{-3}{5})=10-\frac{3}{100}=\boxed{\frac{997}{100}}$

2. (A) -3/0 => Indeterminate => $\boxed{\text{DNE}}$

(B) L'hopital's Rule => $\frac{\frac{1}{3}x^{-2/3}}{\frac{1}{4}x^{-3/4}-1}=\frac{1/3}{-3/4}=\boxed{\frac{-4}{9}}$

(C) L'hopital's Rule (or factoring) => $\frac{\frac{-1}{x^2}}{3x^2}=\frac{-1/4}{12}=\boxed{\frac{-1}{48}}$

(D) L'hopital's Rule => $\frac{-\sec^2 x}{\cos x+\sin x}=\frac{-2}{\sqrt{2}}=\boxed{-\sqrt{2}}$

3. (A) $\frac{n(n+1)(2n+1)}{6}+(18)(4)=\frac{3(19)(37)}{6}+(18)(4)=2109+72=\boxed{2181}$

(B) $\frac{12}{2}(5+27)=(6)(32)=\boxed{192}$

(C) $[(15)(7)]^2+(15)(7)=105^2+105=\boxed{11130}$

(D) $i^2-2i+1=\frac{(10)(11)(21)}{6}-(2)(5)(11)+10=(35)(11)-110+10=\boxed{285}$

4. (A) $\frac{1}{4}\int_0^4(x-2\sqrt{x})dx=\frac{1}{4}(8-\frac{32}{3})=(\frac{1}{4})(\frac{-8}{3})=\boxed{\frac{-2}{3}}$

(B) $\frac{1}{5}\int_0^5(x^2-4)dx=\frac{1}{5}(\frac{125}{3}-20)=(\frac{25}{3}-4)=\frac{13}{3}$

(C) $\frac{1}{7}\int_1^8\frac{2}{x}dx=\frac{2}{7}(\ln 8-\ln 1)=\frac{2}{7}\ln 8=\boxed{\frac{6}{7}\ln 2}$

(D) $\frac{1}{\frac{\pi}{6}-0}\int_0^{\frac{\pi}{6}}(\cos x-\sin x)dx=\frac{6}{\pi}[\frac{1}{2}+\frac{\sqrt{3}}{2}-1]=\frac{3\left(\sqrt{3}-1\right)}{\pi}$

5. h'(x) = f '(x)g(x) + f(x)g'(x), h ''(x) = f '(x)g'(x) + g(x)f ''(x) + f(x)g''(x) + g'(x)f '(x), p'(x) = $\frac{g(x)f'(x)-f(x)g'(x)}{[g(x)]^2}$

   (A) f '(2)g(2) + f(2)g'(2) = (4)(1/2) + (6)(12) = $\boxed{74}$

   (B) $\frac{g(1)f'(1)-f(1)g'(1)}{[g(1)]^2} = \frac{(1/3)(1/4)-(4)(-8)}{(1/3)^2} = \frac{\frac{1}{12}+32}{1/9} = \frac{(385)(9)}{12} = \boxed{\frac{1155}{4}}$

   (C) $\frac{g(2)f'(2)-f(2)g'(2)}{[g(2)]^2} = \frac{(1/2)(4)-(6)(12)}{1/4} = (-70)(4) = \boxed{-280}$

   (D) f '(1)g'(1) + g(1)f "(1) + f(1)g"(1) + g'(1)f '(1) = 2(1/4)(-8) + (1/3)(-3/2) + (4)(10) = -4 – 1/2 + 40 = 36 – 1/2 = $\boxed{\frac{71}{2}}$

6. (A) $4x^3-4x=0 \Rightarrow 4x(x^2-1)=0 \Rightarrow$ x = c = $\boxed{-1, 0, 1}$

   (B) f '(x) = $1-\frac{1}{3}x^{-2/3}$ => not differentiable at x = 0 => $\boxed{\text{Does Not Apply}}$

   (C) f '(c) = 2c = $\frac{1-16}{1-(-4)} = \frac{-15}{5} = -3$ => c = $\boxed{\frac{-3}{2}}$

   (D) f '(c) = $3c^2-6c-4 = \frac{-6-0}{2} = -3 \Rightarrow 3c^2-6c-1=0 \Rightarrow$ c = $\frac{3+2\sqrt{3}}{3}$ and $\frac{3-2\sqrt{3}}{3}$ by quadratic formula…but only $\boxed{\frac{3-2\sqrt{3}}{3}}$ is in the interval [-1, 1]

7. f '(x) = $4x^3-12x^2 = 4x^2(x-3)$ and f ''(x) = $12x^2-24x = 12x(x-2)$
   critical points at x = 0 and x = 3 and possible points of inflection at x = 0 and x = 2

   (A) f ' is positive on $(3,\infty)$ so increasing on $\boxed{(3,\infty)}$
   (B) f ' is negative on $(-\infty,3)$ so decreasing on $\boxed{(-\infty,3)}$
   (C) f '' is positive on $(-\infty,0)$ and $(2,\infty)$ so concave up on $\boxed{(-\infty,0)\cup(2,\infty)}$
   (D) f '' is negative on (0, 2) so concave down on $\boxed{(0, 2)}$

8. (A) = $\int_0^2 (2-x)dx$ = 4 – 4/2 = $\boxed{2}$

   (B) = $\int_0^{3/2} (3-2x)dx + \int_{3/2}^4 (2x-3)dx$ = 9/2 – 9/4 + 16 – 12 – (9/4 – 9/2) = 9 + 4 – 9/2 = $\boxed{\frac{17}{2}}$

   (C) = $\int_0^4 (8-2x)dx + \int_4^5 (2x-8)dx$ = 32 – 16 + 25 – 40 – (16 – 32) = $\boxed{17}$

   (D) = $\int_2^4 (4-x)dx + \int_4^6 (x-4)dx$ = 16 – 8 – (8 – 2) + 18 – 24 – (8 – 16) = $\boxed{4}$

9. (A) xy = 192 and x + y = S => y = 192/x => x + 192/x = S => 1 - $\frac{192}{x^2}$ = S' = 0
=> x = $\sqrt{192}$ (looking for positive value) => y = $\sqrt{192}$
(question says that radicals must be simplified) => (A, B) = $\boxed{(8\sqrt{3}, 8\sqrt{3})}$

(B) xy = 192 and x + 3y = S…using the same substitution procedure as above…
(A, B) = $\boxed{(24, 8)}$
(C) Same substitution procedure as in part (A) above => (A, B) = $\boxed{(6\sqrt{3}, 6\sqrt{3})}$
(D) Same substitution procedure as in part (B) above => (A, B) = $\boxed{(18, 6)}$

10. $(3x)(2yy') + (3y^2) + 2x^2y' + 4xy + 4y' = xy' + y \Rightarrow 6xyy' + 2x^2y' + 4y' - xy' = y - 4xy - 3y^2$
=> $y'(6xy + 2x^2 + 4 - x) = y - 4xy - 3y^2 \Rightarrow y' = \dfrac{y - 4xy - 3y^2}{6xy + 2x^2 + 4 - x}$
(note: all points listed are on the curve)
(A) plugging in (0, 0) into y', we get y' = 0/4 = $\boxed{0}$
(B) plugging in (1, -5/3) into y', we get y' = $\dfrac{\frac{-5}{3} + \frac{20}{3} - \frac{25}{3}}{-10 + 2 + 4 - 1} = \dfrac{\frac{-10}{3}}{-5} = \boxed{\frac{2}{3}}$
(C) using part (B), we take the negative reciprocal and get $\boxed{\frac{-3}{2}}$
(D) plugging in (-1, 7/3) into y', we get y' = $\dfrac{\frac{7}{3} + \frac{28}{3} - \frac{49}{3}}{-14 + 2 + 4 + 1} = \dfrac{\frac{-14}{3}}{-7} = \dfrac{2}{3}$

11. (A) f '($\frac{7\pi}{6}$) = 12(sec $\frac{7\pi}{6}$)(tan $\frac{7\pi}{6}$) = (12) ($\frac{-2}{\sqrt{3}}$)($\frac{\sqrt{3}}{3}$) = $\boxed{-8}$
(B) f '($\frac{14\pi}{3}$) = -3(-csc $\frac{14\pi}{3}$)(cot $\frac{14\pi}{3}$) = (3)($\frac{2}{\sqrt{3}}$)($\frac{-1}{\sqrt{3}}$) = $\boxed{-2}$
(C) f '($\frac{\pi}{4} + \frac{\pi}{6}$) = 4cos($\frac{\pi}{4} + \frac{\pi}{6}$) = 4($\frac{\sqrt{6} - \sqrt{2}}{4}$) = $\boxed{\sqrt{6} - \sqrt{2}}$ (using sum/difference)
(D) f '($\frac{\pi}{4}$ - $\frac{\pi}{6}$) = -20cos($\frac{\pi}{4}$ - $\frac{\pi}{6}$) = -20($\frac{\sqrt{6} + \sqrt{2}}{4}$) = $\boxed{-5(\sqrt{6} - \sqrt{2}) \textbf{ or } 5(\sqrt{2} - \sqrt{6})}$

12. (A) = $\dfrac{(3^5 - 3^1)}{\ln(3)} = \boxed{\dfrac{240}{\ln(3)}}$
(B) letting u = 2x – 1, we get x = $\frac{u+1}{2}$ and dx = $\frac{du}{2}$ …changing our integral…
$$\frac{1}{4}\int_0^4 \frac{u+1}{u^{1/2}}du = \frac{1}{4}\int_0^4 (u^{1/2} + u^{-1/2})du = \frac{1}{4}(\frac{16}{3} + 4) = \boxed{\frac{7}{3}}$$

(C) = $(\sin\frac{\pi}{3} - 2\tan\frac{\pi}{3}) - (\sin\frac{\pi}{4} - 2\tan\frac{\pi}{4}) = \frac{\sqrt{3}}{2} - 2\sqrt{3} - \frac{\sqrt{2}}{2} + 2 = \boxed{\frac{4-\sqrt{2}-3\sqrt{3}}{2}}$

(D) using integration by parts with u = x and dv = $e^x dx$, the integral is equivalent to
$4[xe^x - \int e^x dx] = 4e^x(x-1)$ evaluated from 0 to 4 = $\boxed{12e^4 + 4 \textbf{ or } 4(3e^4+1)}$

13. (A) $f'(x) = \boxed{45x^4 + \frac{1}{x} + \sin x}$

(B) $f''(x) = \boxed{180x^3 + \frac{-1}{x^2} + \cos x}$

(C) $f^{(3)}(x) = \boxed{540x^2 + \frac{2}{x^3} - \sin x}$

(D) $f^{(4)}(x) = \boxed{1080x + \frac{-6}{x^4} - \cos x}$

14. (A) ln(20) = ln(4) + ln(5) = 2ln(2) + ln(5) = 2(0.69) + 1.61 = $\boxed{2.99}$

(B) $\ln(\frac{5}{2})$ = ln(5) – ln(2) = 1.61 – 0.69 = $\boxed{0.92}$

(C) $\ln(\frac{1}{40})$ = ln(1) – ln(40) = 0 – ($\ln(2^3)$ + ln(5) = - [3ln(2) + ln(5)] = -[(3)(0.69) + 1.61]
= $\boxed{-3.68}$

(D) = (1/3)ln(200) = (1/3)[3ln(2) + 2ln(5)] = (1/3)[(3)(0.69) + (2)(1.61)] = 5.29/3 = $\boxed{1.76}$
(to two decimal places as stated in the question)

15. (A) $\boxed{f''(x) = 6x - 12}$ => x = 2 is a possible point of inflection…checking for change of sign confirms that the point (2,8) is the only point of inflection.

(B) $f''(x) = 24x^2$ => x = 0 is a possible point of inflection…checking for change of sign, we determine that there is $\boxed{\text{no point of inflection}}$

(C) $f''(x) = 72x^2 - 54x = 18x(4x-3)$ => x = 0 and x =3/4 are possible points of inflection …checking for change of sign confirms that $\boxed{(0, 0) \text{ and } (3/4, -243/128)}$ are both points of inflection.

(D) $f''(x) = \frac{-1}{4}x^{-3/2} + \frac{3}{4}x^{-5/2} = \frac{-1}{4}x^{-3/2}(1 - \frac{3}{x})$ => x = 0 and x = 3 are possible points of inflection…checking for change of sign we find that only $\boxed{(3, \frac{4\sqrt{3}}{3})}$ is a point of inflection.

1. (A) $\frac{101}{20}$ (B) $\frac{493}{70}$ (C) $\frac{217}{24}$ (D) $\frac{997}{100}$

2. (A) DNE (B) $\frac{-4}{9}$ (C) $\frac{-1}{48}$ (D) $-\sqrt{2}$

3. (A) 2181 (B) 192 (C) 11130 (D) 285

4. (A) $\frac{-2}{3}$ (B) $\frac{13}{3}$ (C) $\frac{6}{7}\ln 2$ (D) $\frac{3\left(\sqrt{3}-1\right)}{\pi}$

5. (A) 74 (B) $\frac{1155}{4}$ (C) -280 (D) $\frac{71}{2}$

6. (A) -1, 0, 1 (in any order) (B) Does Not Apply (C) $\frac{-3}{2}$ (D) $\frac{3-2\sqrt{3}}{3}$

7. (A) $(3,\infty)$ or $[3,\infty)$ (B) $(-\infty,3)$ or $(-\infty,3]$ (C) $(-\infty, 0) \cup (2, \infty)$ (D) (0, 2)

8. (A) 2 (B) $\frac{17}{2}$ (C) 17 (D) 4

9. (A) $(8\sqrt{3},\ 8\sqrt{3})$ (B) (24, 8) (C) $(6\sqrt{3},\ 6\sqrt{3})$ (D) (18, 6)

10. (A) 0 (B) $\frac{2}{3}$ (C) $\frac{-3}{2}$ (D) $\frac{1}{3}$

11. (A) – 8 (B) – 2 (C) $\sqrt{6}-\sqrt{2}$ or $2\sqrt{2-\sqrt{3}}$
    (D) $5(\sqrt{2}-\sqrt{6})$ or $-10\sqrt{2-\sqrt{3}}$ {*or an equivalent form*}

12. (A) $\frac{240}{\ln(3)}$ (C) $\frac{4-\sqrt{2}-3\sqrt{3}}{2}$ {*or an equivalent form*}
    (B) $\frac{7}{3}$ (D) $12e^4+4$ {*or* $4(3e^4+1)$ }

13. (A) $45x^4+\frac{1}{x}+\sin x$ (C) $540x^2+\frac{2}{x^3}-\sin x$
    (B) $180x^3+\frac{-1}{x^2}+\cos x$ (D) $1080x+\frac{-6}{x^4}-\cos x$

14. (A) 2.99 (B) 0.92 (C) – 3.68 (D) 1.76

15. (A) (2,8) (B) No Point of Inflection (C) (0, 0) and (3/4, -243/128) (D) $(3, \frac{4\sqrt{3}}{3})$