

- | | |
|--|-------------------------------------|
| 1) 3 | 14) $4 \ln 2 + 4$ |
| 2) -245 | 15) $y = -\frac{1}{2}x + 10$ |
| 3) 4608 | 16) $\frac{\sqrt{6}}{4}(1 - \ln 2)$ |
| 4) $36\sqrt{2}$ | 17) 2 |
| 5) 1 | 18) $5\sqrt[5]{2} + 5$ |
| 6) $29/6$ | 19) -1 |
| 7) 2039190 | 20) $\frac{8\pi}{3}$ |
| 8) $\frac{\pi}{54}(2917\sqrt{2917} - 37\sqrt{37})$ | 21) $2 + \sqrt{3}$ |
| 9) $\frac{72}{\ln 3}$ | 22) $1/4$ |
| 10) $3\sqrt{3}$ | 23) -3 |
| 11) $6 - 2e$ | 24) 156 |
| 12) 4 | 25) 52π |
| 13) $-\frac{11}{8}$ | |

- 1) $\frac{3^4 - 2 \cdot 3^3 + 7 \cdot 3}{3^3 - 8 \cdot 3 + 13} = \frac{48}{16} = \boxed{3}$
- 2) $20 \cdot 2^4 - 80 \cdot 2^3 + 21 \cdot 2^2 - 9 = 320 - 640 + 84 - 9 = \boxed{-245}$
- 3) $24^3/3 = 24^2 \cdot 8 = 576 \cdot 8 = \boxed{4608}$
- 4) $\int_0^{18} \sqrt{18-x} dx = \left[-\frac{2}{3}(18-x)^{3/2}\right]_0^{18} = \boxed{36\sqrt{2}}$
- 5) $f' = (x+3)^3 + 3(x-1)(x+3)^2 = 4x(x+3)^2 \Rightarrow -3$ is a double root so 0 is the only turning point $\Rightarrow \boxed{1}$
- 6) $\int_0^2 (x^2 - 5x + 6) dx + \frac{(3-2)^3}{6} = \frac{8}{3} - 10 + 12 + \frac{1}{6} = \boxed{\frac{29}{6}}$
- 7) $f(x) = x^{2019} + x^{2018} + \dots + x + 1 \Rightarrow f'(1) = 2019 + 2018 + \dots + 2 + 1 = 2019 \cdot 1010 = \boxed{2039190}$
- 8) $2\pi \int_1^3 2x^3 \sqrt{1+36x^4} dx, u = 1+36x^4 \Rightarrow \frac{\pi}{36} \int_{37}^{2917} \sqrt{u} du = \boxed{\frac{\pi}{54}(2917\sqrt{2917} - 37\sqrt{37})}$
- 9) $\frac{3^4 - 3^2}{\ln 3} = \boxed{\frac{72}{\ln 3}}$
- 10) $y' = e^{\sin \theta}(\sin \theta \cos \theta + \cos \theta) = e^{1/2}(\frac{3\sqrt{3}}{4}), x' = e^{\sin \theta}(\cos^2 \theta - \sin \theta) = e^{1/2}(\frac{1}{4}) \Rightarrow \frac{y'}{x'} = \boxed{3\sqrt{3}}$
- 11) $(x^3 - 3x^2 + 6x - 6)e^x|_0^1 = \boxed{6 - 2e}$
- 12) $3x^2 - 12x + 9 = 0 \Rightarrow x = 1, 3$, and $x = 3$ is a minimum $\Rightarrow 3^3 - 6 \cdot 3^2 + 9 \cdot 3 + 4 = \boxed{4}$
- 13) $3x^2 + 2y^2 + 4xyy' = 0 \Rightarrow 3 + 8 + 8y' = 0 \Rightarrow y' = \boxed{-\frac{11}{8}}$
- 14) $\frac{d}{dx}(x^x)|_{x=2} = 2^2(\ln 2 + 1) = \boxed{4\ln 2 + 4}$
- 15) $y - 8 = -\frac{1}{2}(x - 4) \Rightarrow \boxed{y = -\frac{1}{2}x + 10}$
- 16) $\ln y = \sin x \ln(\sin x) \Rightarrow \frac{y'}{y} = \cos x \ln(\sin x) + \sin x \cot x = \frac{\sqrt{3}}{2}(1 - \ln 2, y = \frac{1}{\sqrt{2}} \Rightarrow y' = \boxed{\frac{\sqrt{6}}{4}(1 - \ln 2)}$
- 17) Coefficient of x^3 term in Maclaurin series is $\frac{f'''(0)}{6} \Rightarrow (1 + 2x + 2x^2 + \frac{4}{3}x^3 + \dots)(1 - x + x^2 - x^3 + \dots) = \dots + (-1 + 2 - 2 + \frac{4}{3})x^3 \dots = \dots + \frac{1}{3}x^3 \dots \Rightarrow 6/3 = \boxed{2}$
- 18) $5\sqrt[5]{x-2}|_1^4 = \boxed{5\sqrt[5]{2} + 5}$
- 19) Partial sum after k terms is $-\frac{k+1}{k+2} \Rightarrow \lim_{k \rightarrow \infty} -\frac{k+1}{k+2} = \boxed{-1}$

$$20) \quad 2\pi \int_0^2 (2x^2 - x^3) dx = 2\pi \left(\frac{16}{3} - 4 \right) = \boxed{\frac{8\pi}{3}}$$

$$21) \quad \tan \frac{5\pi}{12} = \boxed{2 + \sqrt{3}}$$

$$22) \quad \frac{x(1-x^3)}{1-x} = x + x^2 + x^3 \Rightarrow (x + x^2 + x^3)(1 + x^4 + x^8 + \dots) = x + x^2 + x^3 + x^5 + \dots \Rightarrow \text{Using the Maclaurin series } f^{(k)}(0) = 0 \text{ only when } k \text{ is a multiple of } 4 \Rightarrow \boxed{\frac{1}{4}}$$

$$23) \quad y = a \cos x + b \sin x \Rightarrow a = 3 \Rightarrow y(\pi) = -a = \boxed{-3}$$

$$24) \quad 12 \cdot 13 = \boxed{156}$$

$$25) \quad \text{The region is a cylinder capped by two hemispheres} \Rightarrow V = \frac{4}{3}\pi r^3 + \pi r^2 h \Rightarrow V' = 4\pi r^2 r' + 2\pi r r' h + \pi r^2 h' = 32\pi + 24\pi - 4\pi = \boxed{52\pi}$$