I. Find the intervals of monotonicity and extreme points:

1) $y = 2x^3 - 3x^2 + 15$;

2) $y = \dfrac{x^3}{3} - \dfrac{x^2}{2} - 6x + 8$;

3) $y = \dfrac{x}{\ln x}$;

4) $y = (2 + x)e^{-x}$;

5) $y = \dfrac{x^3}{3} + 2x^2 - 12x + 7$;

6) $y = \dfrac{16}{x} + x - 5$;

7) $y = \dfrac{x^2 + 64}{x}$;

8) $y = \dfrac{1 + x^2}{1 - x^2}$.

II. Find the intervals of concavity and inflection points:

1) $y = \dfrac{x^4}{12} - \dfrac{x^3}{2} + x^2 - 7x$;   2) $y = \dfrac{8}{x} + 4x - x^2$;   3) $y = \dfrac{27}{2x} + 2x - \dfrac{x^2}{2}$;

4) $y = -\dfrac{3}{2x} - \dfrac{3}{2}x^2 - 12x$;   5) $y = e^{-x^2}$

III. Evaluate the following integrals, using the direct integration:

1) $\displaystyle\int \dfrac{\sqrt{x} - 2\sqrt[3]{x^5} + 1}{\sqrt[4]{x}}\,dx$;   2) $\displaystyle\int \dfrac{(1-x)^3}{x\sqrt[3]{x}}\,dx$;   3) $\displaystyle\int \dfrac{x^2 + 5}{x^2 - 1}\,dx$;

4) $\displaystyle\int ((x^2 - 4)\cdot(1 - x^3))\,dx$;   5) $\displaystyle\int \left(3\cos x + 2^x \cdot 3^{2x} - \dfrac{1}{9 + x^2}\right)dx$;   6) $\displaystyle\int \dfrac{\cos 2x}{\cos^2 x \cdot \sin^2 x}\,dx$;

7) $\displaystyle\int \dfrac{dx}{\sqrt[3]{4 - 5x}}$;   8) $\displaystyle\int \dfrac{(e^{3x} + 1)}{e^x + 1}\,dx$;   9) $\displaystyle\int \sin(5x - 2)\,dx$;   10) $\displaystyle\int \sqrt{3 - 5x}\cdot dx$;   11) $\displaystyle\int e^{3-5x}\,dx$.

IV. Integrate the following integrals, using the substitution method:

12) $\displaystyle\int \dfrac{e^x}{4 + e^x}\,dx$;   13) $\displaystyle\int \dfrac{x}{1 + 3x^2}\,dx$;   14) $\displaystyle\int \dfrac{\sin(\ln x)}{x}\,dx$;   15) $\displaystyle\int \dfrac{x^3}{9 + x^4}\,dx$;   16) $\displaystyle\int x^2 \cdot e^{2x^3 + 1}\,dx$;

17) $\displaystyle\int \sqrt{\sin x}\cdot\cos x\,dx$;   18) $\displaystyle\int x(3x - 6)^{10}\,dx$;   19) $\displaystyle\int \dfrac{\ln x}{x\cdot\sqrt{1 + \ln x}}\,dx$;   20) $\displaystyle\int \dfrac{x - x^3}{\sqrt{9 - x^4}}\,dx$;

21) $\displaystyle\int \dfrac{3^x}{\sqrt{9 - 9^x}}\,dx$;   22) $\displaystyle\int ctg(4x)\,dx$;   23) $\displaystyle\int \dfrac{\arcsin x - x}{\sqrt{1 - x^2}}\,dx$;   24) $\displaystyle\int \dfrac{3x - 2}{3x^2 - 4x}\,dx$.

25) $\displaystyle\int \dfrac{\cos x}{\sqrt{1 - \sin^2 x}}\,dx$.

V. Evaluate the following integrals, using the integration by parts:

26) $\int x \cdot 2^{-x} dx$;

27) $\int (x^2 + 4) \cdot \sin 2x \cdot dx$;

28) $\int \ln^2 x dx$;

29) $\int (2x - 3) \cdot \cos 2x dx$;

30) $\int \dfrac{x}{\sin^2 x} dx$;

31) $\int \dfrac{\ln x}{\sqrt{x}} dx$;

32) $\int e^{\sqrt{2x+3}} dx$;

33) $\int \sin \sqrt{x+5} dx$;

34) $\int \arcsin x dx$;

35) $\int \arctan x dx$