



10

31

1. $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

2

2. $\frac{1}{4} \times \frac{1}{5} = \frac{1}{20}$

2

3. $\frac{1}{6} \times \frac{1}{7} = \frac{1}{42}$

2

4. $\frac{1}{8} \times \frac{1}{9} = \frac{1}{72}$

5. $\frac{1}{10} \times \frac{1}{11} = \frac{1}{110}$

6. $\frac{1}{12} \times \frac{1}{13} = \frac{1}{156}$

4

7. $\frac{1}{14} \times \frac{1}{15} = \frac{1}{210}$

8. $\frac{1}{16} \times \frac{1}{17} = \frac{1}{272}$

9. $\frac{1}{18} \times \frac{1}{19} = \frac{1}{342}$

10. $\frac{1}{20} \times \frac{1}{21} = \frac{1}{420}$

11. $\frac{1}{22} \times \frac{1}{23} = \frac{1}{506}$

12. $\frac{1}{24} \times \frac{1}{25} = \frac{1}{600}$

13. $\frac{1}{26} \times \frac{1}{27} = \frac{1}{702}$

14. $\frac{1}{28} \times \frac{1}{29} = \frac{1}{812}$

15. $\frac{1}{30} \times \frac{1}{31} = \frac{1}{930}$

16. $\frac{1}{32} \times \frac{1}{33} = \frac{1}{1056}$

17. $\frac{1}{34} \times \frac{1}{35} = \frac{1}{1190}$

40

11

41

1. $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

41

2. $\frac{1}{4} \times \frac{1}{5} = \frac{1}{20}$

42

3. $\frac{1}{6} \times \frac{1}{7} = \frac{1}{42}$

42

12

42

1. $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

42

2. $\frac{1}{4} \times \frac{1}{5} = \frac{1}{20}$

42

3. $\frac{1}{6} \times \frac{1}{7} = \frac{1}{42}$

4

4. $\frac{1}{8} \times \frac{1}{9} = \frac{1}{72}$

4

5. $\frac{1}{10} \times \frac{1}{11} = \frac{1}{110}$

4

6. $\frac{1}{12} \times \frac{1}{13} = \frac{1}{156}$

4

7. $\frac{1}{14} \times \frac{1}{15} = \frac{1}{210}$

44

8. $\frac{1}{16} \times \frac{1}{17} = \frac{1}{272}$

4

13

4/8

1. $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

4

2. $\frac{1}{4} \times \frac{1}{5} = \frac{1}{20}$

4

3. $\frac{1}{6} \times \frac{1}{7} = \frac{1}{42}$

4

4. $\frac{1}{8} \times \frac{1}{9} = \frac{1}{72}$

4

5. $\frac{1}{10} \times \frac{1}{11} = \frac{1}{110}$

4

→ $\frac{1}{2} \ln \left| \frac{1+x}{1-x} \right| + C$

→ $\frac{1}{2} \ln \left| \frac{1+\frac{1}{2}}{1-\frac{1}{2}} \right| + C = \frac{1}{2} \ln 3 + C$

→ $\frac{1}{2} \ln 3 + C$

→ $\frac{1}{2} \ln 3 + \frac{1}{2} \ln 3 = \ln 3$

→ $\frac{1}{2} \ln 3 + \frac{1}{2} \ln 3 = \ln 3$

→ $\frac{1}{2} \ln 3 + \frac{1}{2} \ln 3 = \ln 3$ → $\frac{1}{2} \ln 3 + \frac{1}{2} \ln 3 = \ln 3$

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→ $\frac{1}{2} \ln 3 + \frac{1}{2} \ln 3 = \ln 3$

→ $\frac{1}{2} \ln 3 + \frac{1}{2} \ln 3 = \ln 3$

1. $\int_0^1 x^2 dx = \frac{1}{3}$

2. $\int_0^1 x^3 dx = \frac{1}{4}$

3. $\int_0^1 x^4 dx = \frac{1}{5}$

4. $\int_0^1 x^5 dx = \frac{1}{6}$

5. $\int_0^1 x^6 dx = \frac{1}{7}$

6. $\int_0^1 x^7 dx = \frac{1}{8}$

7. $\int_0^1 x^8 dx = \frac{1}{9}$

8. $\int_0^1 x^9 dx = \frac{1}{10}$

9. $\int_0^1 x^{10} dx = \frac{1}{11}$

10. $\int_0^1 x^{11} dx = \frac{1}{12}$

11. $\int_0^1 x^{12} dx = \frac{1}{13}$

12. $\int_0^1 x^{13} dx = \frac{1}{14}$

13. $\int_0^1 x^{14} dx = \frac{1}{15}$

14. $\int_0^1 x^{15} dx = \frac{1}{16}$

15. $\int_0^1 x^{16} dx = \frac{1}{17}$

16. $\int_0^1 x^{17} dx = \frac{1}{18}$

17. $\int_0^1 x^{18} dx = \frac{1}{19}$

18. $\int_0^1 x^{19} dx = \frac{1}{20}$

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24. $\int_0^1 x^{25} dx = \frac{1}{26}$

25. $\int_0^1 x^{26} dx = \frac{1}{27}$

1. $\int_0^1 x^2 dx = \frac{1}{3}$
 2. $\int_0^1 x^3 dx = \frac{1}{4}$
 3. $\int_0^1 x^4 dx = \frac{1}{5}$
 4. $\int_0^1 x^5 dx = \frac{1}{6}$
 5. $\int_0^1 x^6 dx = \frac{1}{7}$

• $\int_0^1 x^2 dx = \frac{1}{3}$

1. $\int_0^1 x^2 dx = \frac{1}{3}$
 2. $\int_0^1 x^3 dx = \frac{1}{4}$
 3. $\int_0^1 x^4 dx = \frac{1}{5}$
 4. $\int_0^1 x^5 dx = \frac{1}{6}$
 5. $\int_0^1 x^6 dx = \frac{1}{7}$

• $\int_0^1 x^2 dx = \frac{1}{3}$

1. $\int_0^1 x^2 dx = \frac{1}{3}$
 2. $\int_0^1 x^3 dx = \frac{1}{4}$
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• $\int_0^1 x^2 dx = \frac{1}{3}$

1. $\int_0^1 x^2 dx = \frac{1}{3}$
 2. $\int_0^1 x^3 dx = \frac{1}{4}$
 3. $\int_0^1 x^4 dx = \frac{1}{5}$
 4. $\int_0^1 x^5 dx = \frac{1}{6}$
 5. $\int_0^1 x^6 dx = \frac{1}{7}$

1. $\int_0^1 x^2 dx = \frac{1}{3} x^3 \Big|_0^1 = \frac{1}{3} (1^3 - 0^3) = \frac{1}{3}$

2. $\int_0^1 x^3 dx = \frac{1}{4} x^4 \Big|_0^1 = \frac{1}{4} (1^4 - 0^4) = \frac{1}{4}$

3. $\int_0^1 x^4 dx = \frac{1}{5} x^5 \Big|_0^1 = \frac{1}{5} (1^5 - 0^5) = \frac{1}{5}$

4. $\int_0^1 x^5 dx = \frac{1}{6} x^6 \Big|_0^1 = \frac{1}{6} (1^6 - 0^6) = \frac{1}{6}$

5. $\int_0^1 x^6 dx = \frac{1}{7} x^7 \Big|_0^1 = \frac{1}{7} (1^7 - 0^7) = \frac{1}{7}$

6. $\int_0^1 x^7 dx = \frac{1}{8} x^8 \Big|_0^1 = \frac{1}{8} (1^8 - 0^8) = \frac{1}{8}$

7. $\int_0^1 x^8 dx = \frac{1}{9} x^9 \Big|_0^1 = \frac{1}{9} (1^9 - 0^9) = \frac{1}{9}$

8. $\int_0^1 x^9 dx = \frac{1}{10} x^{10} \Big|_0^1 = \frac{1}{10} (1^{10} - 0^{10}) = \frac{1}{10}$

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Handwritten text, possibly a list or notes, with some symbols and numbers.

Handwritten text, possibly a list or notes, with some symbols and numbers.

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Day Student Illness: (... ..) 22 0

Novel Viruses, Pandemic, and Community Health:

• *Novel Viruses*

... .. 10%

... .. (... ..)

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• *Novel Viruses*

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Handwritten notes in the third section, including a blue arrow pointing to the right and the text "12 ()".

Handwritten notes in the fourth section, containing several lines of text and a blue arrow pointing downwards.

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10.1

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Handwritten notes for section 10.1, including mathematical expressions like $(-1)^n$ and $(-1)^{n+1}$.

Handwritten notes for section 10.1, including the number 222 in parentheses.

10

Handwritten notes for section 10, including mathematical expressions like $(-1)^n$ and $(-1)^{n+1}$.

Handwritten notes for section 10, including mathematical expressions like $(-1)^n$ and $(-1)^{n+1}$.

Handwritten notes for section 10, including mathematical expressions like $(-1)^n$ and $(-1)^{n+1}$.

المسألة الأولى: (10 درجات)

أثبت أن مجموع الجذور الحقيقية للمعادلة $x^3 - 3x^2 + 2x - 1 = 0$ يساوي 3.

الحل: نعلم أن مجموع الجذور الحقيقية للمعادلة $x^3 + ax^2 + bx + c = 0$ يساوي $-a$.

في هذه الحالة $a = -3$ ، إذن مجموع الجذور الحقيقية للمعادلة $x^3 - 3x^2 + 2x - 1 = 0$ يساوي $-(-3) = 3$.

المسألة الثانية: (10 درجات)

أثبت أن مجموع الجذور الحقيقية للمعادلة $x^3 - 3x^2 + 2x - 1 = 0$ يساوي 3.

... (1) ... / ... / ...

... (2) ...

... 0-0 ...

... / ...

... (3) ...

... 0 ...

... (4) ...

... (5) ...

1. Introduction

The first part of the document discusses the importance of understanding the underlying principles of the system. It highlights the need for a thorough analysis of the data and the identification of key variables. The second part of the document focuses on the development of a robust model that can handle various input scenarios. This involves a combination of statistical methods and machine learning techniques. The final part of the document provides a detailed evaluation of the model's performance, comparing it against a set of benchmark tests. The results show that the proposed model outperforms the existing methods in terms of accuracy and efficiency.

The second part of the document discusses the implementation of the model. It details the software tools and libraries used, as well as the hardware requirements. The third part of the document provides a comprehensive overview of the model's architecture, including the data flow and the processing steps. The fourth part of the document discusses the results of the model's performance, comparing it against a set of benchmark tests. The results show that the proposed model outperforms the existing methods in terms of accuracy and efficiency.

The fifth part of the document discusses the future work and the potential applications of the model. It highlights the need for further research in the area of model optimization and the integration of new data sources. The sixth part of the document provides a detailed overview of the model's architecture, including the data flow and the processing steps. The seventh part of the document discusses the results of the model's performance, comparing it against a set of benchmark tests. The results show that the proposed model outperforms the existing methods in terms of accuracy and efficiency.

1. $\frac{1}{x^2} = x^{-2}$
2. $\frac{d}{dx} x^{-2} = -2x^{-3}$
3. $= -\frac{2}{x^3}$

4. $\frac{d}{dx} \frac{1}{x^2} = -\frac{2}{x^3}$
5. $\frac{d}{dx} \frac{1}{x^2} = -\frac{2}{x^3}$
6. $\frac{d}{dx} \frac{1}{x^2} = -\frac{2}{x^3}$
7. $\frac{d}{dx} \frac{1}{x^2} = -\frac{2}{x^3}$

8. $\frac{d}{dx} \frac{1}{x^2} = -\frac{2}{x^3}$

1. $\int \frac{1}{x^2} dx = \int x^{-2} dx = \frac{x^{-1}}{-1} + C = -\frac{1}{x} + C$

2. $\int \frac{1}{x^3} dx = \int x^{-3} dx = \frac{x^{-2}}{-2} + C = -\frac{1}{2x^2} + C$

3. $\int \frac{1}{x} dx = \ln|x| + C$

4. $\int \frac{1}{x^2+1} dx = \int \frac{1}{x^2+1} dx = \arctan(x) + C$

5. $\int \frac{1}{x^2-1} dx = \int \frac{1}{(x-1)(x+1)} dx = \frac{1}{2} \ln \left| \frac{x-1}{x+1} \right| + C$

6. $\int \frac{1}{x^2+4} dx = \int \frac{1}{x^2+2^2} dx = \frac{1}{2} \arctan \left(\frac{x}{2} \right) + C$

• Integration by Substitution

7. $\int 2x \cos(x^2) dx$
Let $u = x^2$, then $du = 2x dx$
 $\int \cos(u) du = \sin(u) + C = \sin(x^2) + C$

8. $\int \frac{1}{\sqrt{x}} dx = \int x^{-1/2} dx = \frac{x^{1/2}}{1/2} + C = 2\sqrt{x} + C$

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12

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1. $\sum_{k=1}^n k^2 = \frac{1}{3}n^3 + \frac{1}{2}n^2 + \frac{1}{6}n$

Wir zeigen die Formel durch Induktion. Für $n=1$ gilt $1^2 = \frac{1}{3} + \frac{1}{2} + \frac{1}{6} = 1$.
Angenommen die Formel gilt für n . Dann gilt für $n+1$:
$$\sum_{k=1}^{n+1} k^2 = \sum_{k=1}^n k^2 + (n+1)^2 = \frac{1}{3}n^3 + \frac{1}{2}n^2 + \frac{1}{6}n + n^2 + 2n + 1$$
$$= \frac{1}{3}(n^3 + 3n^2 + 3n + 1) + \frac{1}{2}(n^2 + 2n + 1) + \frac{1}{6}(n+1)$$
$$= \frac{1}{3}(n+1)^3 + \frac{1}{2}(n+1)^2 + \frac{1}{6}(n+1)$$

2. $\sum_{k=1}^n k^3 = \frac{1}{4}n^4 + \frac{1}{2}n^3 + \frac{1}{4}n^2$

Wir zeigen die Formel durch Induktion. Für $n=1$ gilt $1^3 = \frac{1}{4} + \frac{1}{2} + \frac{1}{4} = 1$.
Angenommen die Formel gilt für n . Dann gilt für $n+1$:
$$\sum_{k=1}^{n+1} k^3 = \sum_{k=1}^n k^3 + (n+1)^3 = \frac{1}{4}n^4 + \frac{1}{2}n^3 + \frac{1}{4}n^2 + n^3 + 3n^2 + 3n + 1$$
$$= \frac{1}{4}(n^4 + 4n^3 + 6n^2 + 4n + 1) + \frac{1}{2}(n^3 + 3n^2 + 3n + 1) + \frac{1}{4}(n^2 + 2n + 1)$$
$$= \frac{1}{4}(n+1)^4 + \frac{1}{2}(n+1)^3 + \frac{1}{4}(n+1)^2$$

3. $\sum_{k=1}^n k^4 = \frac{1}{5}n^5 + \frac{1}{2}n^4 + \frac{1}{3}n^3 + \frac{1}{4}n^2$

Wir zeigen die Formel durch Induktion. Für $n=1$ gilt $1^4 = \frac{1}{5} + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} = 1$.
Angenommen die Formel gilt für n . Dann gilt für $n+1$:
$$\sum_{k=1}^{n+1} k^4 = \sum_{k=1}^n k^4 + (n+1)^4 = \frac{1}{5}n^5 + \frac{1}{2}n^4 + \frac{1}{3}n^3 + \frac{1}{4}n^2 + n^4 + 4n^3 + 6n^2 + 4n + 1$$
$$= \frac{1}{5}(n^5 + 5n^4 + 10n^3 + 10n^2 + 5n + 1) + \frac{1}{2}(n^4 + 4n^3 + 6n^2 + 4n + 1) + \frac{1}{3}(n^3 + 3n^2 + 3n + 1) + \frac{1}{4}(n^2 + 2n + 1)$$
$$= \frac{1}{5}(n+1)^5 + \frac{1}{2}(n+1)^4 + \frac{1}{3}(n+1)^3 + \frac{1}{4}(n+1)^2$$

4. $\sum_{k=1}^n k^5 = \frac{1}{6}n^6 + \frac{1}{2}n^5 + \frac{5}{12}n^4 + \frac{1}{4}n^3$

Wir zeigen die Formel durch Induktion. Für $n=1$ gilt $1^5 = \frac{1}{6} + \frac{1}{2} + \frac{5}{12} + \frac{1}{4} = 1$.
Angenommen die Formel gilt für n . Dann gilt für $n+1$:
$$\sum_{k=1}^{n+1} k^5 = \sum_{k=1}^n k^5 + (n+1)^5 = \frac{1}{6}n^6 + \frac{1}{2}n^5 + \frac{5}{12}n^4 + \frac{1}{4}n^3 + n^5 + 5n^4 + 10n^3 + 10n^2 + 5n + 1$$
$$= \frac{1}{6}(n^6 + 6n^5 + 15n^4 + 20n^3 + 15n^2 + 6n + 1) + \frac{1}{2}(n^5 + 5n^4 + 10n^3 + 10n^2 + 5n + 1) + \frac{5}{12}(n^4 + 4n^3 + 6n^2 + 4n + 1) + \frac{1}{4}(n^3 + 3n^2 + 3n + 1)$$
$$= \frac{1}{6}(n+1)^6 + \frac{1}{2}(n+1)^5 + \frac{5}{12}(n+1)^4 + \frac{1}{4}(n+1)^3$$

5. $\sum_{k=1}^n k^6 = \frac{1}{7}n^7 + \frac{1}{2}n^6 + \frac{1}{2}n^5 + \frac{1}{4}n^4 + \frac{1}{6}n^3$

Wir zeigen die Formel durch Induktion. Für $n=1$ gilt $1^6 = \frac{1}{7} + \frac{1}{2} + \frac{1}{2} + \frac{1}{4} + \frac{1}{6} = 1$.
Angenommen die Formel gilt für n . Dann gilt für $n+1$:
$$\sum_{k=1}^{n+1} k^6 = \sum_{k=1}^n k^6 + (n+1)^6 = \frac{1}{7}n^7 + \frac{1}{2}n^6 + \frac{1}{2}n^5 + \frac{1}{4}n^4 + \frac{1}{6}n^3 + n^6 + 6n^5 + 15n^4 + 20n^3 + 15n^2 + 6n + 1$$
$$= \frac{1}{7}(n^7 + 7n^6 + 21n^5 + 35n^4 + 35n^3 + 21n^2 + 7n + 1) + \frac{1}{2}(n^6 + 6n^5 + 15n^4 + 20n^3 + 15n^2 + 6n + 1) + \frac{1}{2}(n^5 + 5n^4 + 10n^3 + 10n^2 + 5n + 1) + \frac{1}{4}(n^4 + 4n^3 + 6n^2 + 4n + 1) + \frac{1}{6}(n^3 + 3n^2 + 3n + 1)$$
$$= \frac{1}{7}(n+1)^7 + \frac{1}{2}(n+1)^6 + \frac{1}{2}(n+1)^5 + \frac{1}{4}(n+1)^4 + \frac{1}{6}(n+1)^3$$

6. $\sum_{k=1}^n k^7 = \frac{1}{8}n^8 + \frac{1}{2}n^7 + \frac{7}{8}n^6 + \frac{1}{4}n^5 + \frac{7}{24}n^4 + \frac{1}{6}n^3$

Wir zeigen die Formel durch Induktion. Für $n=1$ gilt $1^7 = \frac{1}{8} + \frac{1}{2} + \frac{7}{8} + \frac{1}{4} + \frac{7}{24} + \frac{1}{6} = 1$.
Angenommen die Formel gilt für n . Dann gilt für $n+1$:
$$\sum_{k=1}^{n+1} k^7 = \sum_{k=1}^n k^7 + (n+1)^7 = \frac{1}{8}n^8 + \frac{1}{2}n^7 + \frac{7}{8}n^6 + \frac{1}{4}n^5 + \frac{7}{24}n^4 + \frac{1}{6}n^3 + n^7 + 7n^6 + 21n^5 + 35n^4 + 35n^3 + 21n^2 + 7n + 1$$
$$= \frac{1}{8}(n^8 + 8n^7 + 28n^6 + 56n^5 + 70n^4 + 56n^3 + 28n^2 + 8n + 1) + \frac{1}{2}(n^7 + 7n^6 + 21n^5 + 35n^4 + 35n^3 + 21n^2 + 7n + 1) + \frac{7}{8}(n^6 + 6n^5 + 15n^4 + 20n^3 + 15n^2 + 6n + 1) + \frac{1}{4}(n^5 + 5n^4 + 10n^3 + 10n^2 + 5n + 1) + \frac{7}{24}(n^4 + 4n^3 + 6n^2 + 4n + 1) + \frac{1}{6}(n^3 + 3n^2 + 3n + 1)$$
$$= \frac{1}{8}(n+1)^8 + \frac{1}{2}(n+1)^7 + \frac{7}{8}(n+1)^6 + \frac{1}{4}(n+1)^5 + \frac{7}{24}(n+1)^4 + \frac{1}{6}(n+1)^3$$

7. $\sum_{k=1}^n k^8 = \frac{1}{9}n^9 + \frac{1}{2}n^8 + \frac{2}{3}n^7 + \frac{1}{4}n^6 + \frac{7}{30}n^5 + \frac{1}{6}n^4 + \frac{1}{42}n^3$

Wir zeigen die Formel durch Induktion. Für $n=1$ gilt $1^8 = \frac{1}{9} + \frac{1}{2} + \frac{2}{3} + \frac{1}{4} + \frac{7}{30} + \frac{1}{6} + \frac{1}{42} = 1$.
Angenommen die Formel gilt für n . Dann gilt für $n+1$:
$$\sum_{k=1}^{n+1} k^8 = \sum_{k=1}^n k^8 + (n+1)^8 = \frac{1}{9}n^9 + \frac{1}{2}n^8 + \frac{2}{3}n^7 + \frac{1}{4}n^6 + \frac{7}{30}n^5 + \frac{1}{6}n^4 + \frac{1}{42}n^3 + n^8 + 8n^7 + 28n^6 + 56n^5 + 70n^4 + 56n^3 + 28n^2 + 8n + 1$$
$$= \frac{1}{9}(n^9 + 9n^8 + 36n^7 + 84n^6 + 126n^5 + 126n^4 + 84n^3 + 36n^2 + 9n + 1) + \frac{1}{2}(n^8 + 8n^7 + 28n^6 + 56n^5 + 70n^4 + 56n^3 + 28n^2 + 8n + 1) + \frac{2}{3}(n^7 + 7n^6 + 21n^5 + 35n^4 + 35n^3 + 21n^2 + 7n + 1) + \frac{1}{4}(n^6 + 6n^5 + 15n^4 + 20n^3 + 15n^2 + 6n + 1) + \frac{7}{30}(n^5 + 5n^4 + 10n^3 + 10n^2 + 5n + 1) + \frac{1}{6}(n^4 + 4n^3 + 6n^2 + 4n + 1) + \frac{1}{42}(n^3 + 3n^2 + 3n + 1)$$
$$= \frac{1}{9}(n+1)^9 + \frac{1}{2}(n+1)^8 + \frac{2}{3}(n+1)^7 + \frac{1}{4}(n+1)^6 + \frac{7}{30}(n+1)^5 + \frac{1}{6}(n+1)^4 + \frac{1}{42}(n+1)^3$$

8. $\sum_{k=1}^n k^9 = \frac{1}{10}n^{10} + \frac{1}{2}n^9 + \frac{3}{2}n^8 + \frac{3}{4}n^7 + \frac{5}{24}n^6 + \frac{1}{6}n^5 + \frac{1}{42}n^4 + \frac{1}{42}n^3$

Wir zeigen die Formel durch Induktion. Für $n=1$ gilt $1^9 = \frac{1}{10} + \frac{1}{2} + \frac{3}{2} + \frac{3}{4} + \frac{5}{24} + \frac{1}{6} + \frac{1}{42} + \frac{1}{42} = 1$.
Angenommen die Formel gilt für n . Dann gilt für $n+1$:
$$\sum_{k=1}^{n+1} k^9 = \sum_{k=1}^n k^9 + (n+1)^9 = \frac{1}{10}n^{10} + \frac{1}{2}n^9 + \frac{3}{2}n^8 + \frac{3}{4}n^7 + \frac{5}{24}n^6 + \frac{1}{6}n^5 + \frac{1}{42}n^4 + \frac{1}{42}n^3 + n^9 + 9n^8 + 36n^7 + 84n^6 + 126n^5 + 126n^4 + 84n^3 + 36n^2 + 9n + 1$$
$$= \frac{1}{10}(n^{10} + 10n^9 + 45n^8 + 120n^7 + 252n^6 + 420n^5 + 504n^4 + 420n^3 + 252n^2 + 10n + 1) + \frac{1}{2}(n^9 + 9n^8 + 36n^7 + 84n^6 + 126n^5 + 126n^4 + 84n^3 + 36n^2 + 9n + 1) + \frac{3}{2}(n^8 + 8n^7 + 28n^6 + 56n^5 + 70n^4 + 56n^3 + 28n^2 + 8n + 1) + \frac{3}{4}(n^7 + 7n^6 + 21n^5 + 35n^4 + 35n^3 + 21n^2 + 7n + 1) + \frac{5}{24}(n^6 + 6n^5 + 15n^4 + 20n^3 + 15n^2 + 6n + 1) + \frac{1}{6}(n^5 + 5n^4 + 10n^3 + 10n^2 + 5n + 1) + \frac{1}{42}(n^4 + 4n^3 + 6n^2 + 4n + 1) + \frac{1}{42}(n^3 + 3n^2 + 3n + 1)$$
$$= \frac{1}{10}(n+1)^{10} + \frac{1}{2}(n+1)^9 + \frac{3}{2}(n+1)^8 + \frac{3}{4}(n+1)^7 + \frac{5}{24}(n+1)^6 + \frac{1}{6}(n+1)^5 + \frac{1}{42}(n+1)^4 + \frac{1}{42}(n+1)^3$$

1. The first part of the text discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

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1.1.1.1

Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ sei durch $f(x) = x^2 + 2x - 3$ für alle $x \in \mathbb{R}$ definiert. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$.

Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ sei durch $f(x) = x^2 + 2x - 3$ für alle $x \in \mathbb{R}$ definiert. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$.

1.1.1.2

Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ sei durch $f(x) = x^2 + 2x - 3$ für alle $x \in \mathbb{R}$ definiert. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$.

Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ sei durch $f(x) = x^2 + 2x - 3$ für alle $x \in \mathbb{R}$ definiert. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$.

1.1.1.3

Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ sei durch $f(x) = x^2 + 2x - 3$ für alle $x \in \mathbb{R}$ definiert. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$.



1.1.1.4

Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ sei durch $f(x) = x^2 + 2x - 3$ für alle $x \in \mathbb{R}$ definiert. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$. Die Nullstellen von f sind $x_1 = -3$ und $x_2 = 1$.

1. Die folgenden Aussagen sind wahr oder falsch? Begründen Sie!

10. Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$ gegeben. Dann ist f in $x=0$ differenzierbar. 10
11. Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$ gegeben. Dann ist f in $x=0$ zweifach differenzierbar. 10
12. Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$ gegeben. Dann ist f in $x=0$ dreifach differenzierbar. 10

2. Gegeben sei die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ durch $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$.

10. Berechnen Sie $f'(0)$.
11. Berechnen Sie $f''(0)$.
12. Berechnen Sie $f'''(0)$.

3. Gegeben sei die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ durch $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$.

Berechnen Sie $f'(x)$ für $x \neq 0$.

4. Gegeben sei die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ durch $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$.

11. Berechnen Sie $f'(x)$ für $x \neq 0$.
12. Berechnen Sie $f''(x)$ für $x \neq 0$.

- Berechnen Sie $f'''(x)$ für $x \neq 0$.

5. Gegeben sei die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ durch $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$.

11. Berechnen Sie $f'(x)$ für $x \neq 0$.
12. Berechnen Sie $f''(x)$ für $x \neq 0$.

6. Gegeben sei die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ durch $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$.

11. Berechnen Sie $f'(x)$ für $x \neq 0$.
12. Berechnen Sie $f''(x)$ für $x \neq 0$.

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1. $\int_{-\infty}^{\infty} \delta(x) dx = 1$ (normalization)
2. $\int_{-\infty}^{\infty} x \delta(x) dx = 0$ (odd function)
3. $\int_{-\infty}^{\infty} x^n \delta(x) dx = 0$ for $n > 0$

4. $\int_{-\infty}^{\infty} f(x) \delta(x) dx = f(0)$ (sifting property)

3. Properties

1. $\delta(x) = \delta(-x)$ (even function)
2. $\delta(ax) = \frac{1}{|a|} \delta(x)$ (scaling)
3. $\delta(x) \delta(x) = \delta(x)$ (idempotent)

4. $\delta(x) \delta(x-a) = 0$ (orthogonality)

4. Applications

1. $\int_{-\infty}^{\infty} f(x) \delta(x-a) dx = f(a)$
2. $\int_{-\infty}^{\infty} f(x) \delta(x-a) dx = f(a)$
3. $\int_{-\infty}^{\infty} f(x) \delta(x-a) dx = f(a)$

5. Generalized Functions

1. $\delta(x)$ is a generalized function
2. $\delta(x)$ is a distribution
3. $\delta(x)$ is a measure

4. $\delta(x)$ is a linear functional

5. $\delta(x)$ is a continuous linear functional

6. $\delta(x)$ is a continuous linear functional

7. $\delta(x)$ is a continuous linear functional

8. $\delta(x)$ is a continuous linear functional

9. $\delta(x)$ is a continuous linear functional

» $\delta(x)$ is a continuous linear functional

» $\delta(x)$ is a continuous linear functional



QUESTION

1. Explain the difference between a *strongly typed* language and a *weakly typed* language. Give examples of each.

ANSWER QUESTION 1

- In a *strongly typed* language, the compiler checks the types of variables and expressions at compile time. If there is a type mismatch, the compiler will generate an error.
- In a *weakly typed* language, the compiler does not check the types of variables and expressions at compile time. Instead, it allows the program to run and only generates an error if a type mismatch occurs at runtime.

ANSWER QUESTION 2

- *Strongly typed* languages are designed to catch errors at compile time, which can help prevent runtime errors and improve the reliability of the program.
- *Weakly typed* languages are designed to be more flexible and allow for more dynamic behavior, but they can also be more prone to runtime errors.
- Examples of *strongly typed* languages include C, C++, Java, and C#. Examples of *weakly typed* languages include JavaScript, Python, and PHP.

1. $\int_{-\infty}^{\infty} \delta(x) dx = 1$

2. $\int_{-\infty}^{\infty} \delta(x) f(x) dx = f(0)$

3. $\int_{-\infty}^{\infty} \delta(x) dx = 1$ (if $f(x) = 1$)

4. $\int_{-\infty}^{\infty} \delta(x) dx = 1$

5. $\int_{-\infty}^{\infty} \delta(x) dx = 1$ (if $f(x) = 1$)

6. $\int_{-\infty}^{\infty} \delta(x) dx = 1$

7. $\int_{-\infty}^{\infty} \delta(x) dx = 1$ (if $f(x) = 1$)

8. $\int_{-\infty}^{\infty} \delta(x) dx = 1$ (if $f(x) = 1$)

9. $\int_{-\infty}^{\infty} \delta(x) dx = 1$

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▶ Wiederholungsfragen

1. Was ist die Bedeutung der δ -Funktion? Wie wird sie definiert? Wie wird sie in der Physik verwendet?

2. Wie wird die δ -Funktion in der Physik verwendet? Nenne Beispiele für die Anwendung der δ -Funktion in der Physik.

3. Wie wird die δ -Funktion in der Physik verwendet? Nenne Beispiele für die Anwendung der δ -Funktion in der Physik.

▶ Wiederholungsfragen

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▶ Wiederholungsfragen

1. Wie wird die δ -Funktion in der Physik verwendet? Nenne Beispiele für die Anwendung der δ -Funktion in der Physik.

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1. $\int_0^1 x^2 dx = \frac{1}{3}$ (by the power rule)

2. $\int_0^1 x^3 dx = \frac{1}{4}$ (by the power rule)

Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ sei durch $f(x) = x^2 + 2x - 3$ gegeben.

1. Bestimmen Sie die Nullstellen der Funktion f .

Lösung: Die Nullstellen sind die Lösungen der Gleichung $x^2 + 2x - 3 = 0$.
Wir lösen dies durch Faktorisieren:
 $x^2 + 2x - 3 = (x + 3)(x - 1) = 0$
Daher sind die Nullstellen $x_1 = -3$ und $x_2 = 1$.

2. Skizzieren Sie den Graphen der Funktion f .

Lösung: Die Funktion $f(x) = x^2 + 2x - 3$ ist eine Parabel, die nach oben geöffnet ist. Die Nullstellen sind $x_1 = -3$ und $x_2 = 1$. Die Scheitelpunktform der Parabel ist $f(x) = (x + 1)^2 - 4$. Die Scheitelpunktformel liefert den Scheitelpunkt bei $(-1, -4)$. Die Parabel schneidet die y-Achse bei $y = -3$.

3. Bestimmen Sie die Ableitung der Funktion f .

Lösung: Die Ableitung der Funktion $f(x) = x^2 + 2x - 3$ ist $f'(x) = 2x + 2$.

4. Bestimmen Sie die Ableitung der Funktion $g(x) = \sqrt{x}$.

Lösung: Die Ableitung der Funktion $g(x) = \sqrt{x} = x^{1/2}$ ist $g'(x) = \frac{1}{2} x^{-1/2} = \frac{1}{2\sqrt{x}}$.

5. Bestimmen Sie die Ableitung der Funktion $h(x) = \ln(x)$.

6. Bestimmen Sie die Ableitung der Funktion $k(x) = e^x$.

Lösung: Die Ableitung der Funktion $k(x) = e^x$ ist $k'(x) = e^x$.

7.

Bestimmen Sie die Ableitung der Funktion $l(x) = \sin(x)$.

Lösung: Die Ableitung der Funktion $l(x) = \sin(x)$ ist $l'(x) = \cos(x)$.

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1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.

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