

## Analiza matematyczna

**46.** Oblicz granicę ciągu  $(a_n)$ , jeśli

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|--|---------------------------|-------------------------------|--|
| 1. $a_n = 1 + \frac{2}{n} - \frac{3}{n^2}$ | 5. $a_n = n^4 - 2n^3 + 1$ | 9. $a_n = \frac{5n-1}{n+1}$   | 13. $a_n = \frac{2}{4-n}$              |
| 2. $a_n = (1 + \frac{2}{n})^2$             | 6. $a_n = 4 - n - 3n^3$   | 10. $a_n = \frac{1-2n}{10+n}$ | 14. $a_n = (\frac{2n-1}{4n+1})^2$      |
| 3. $a_n = 2n - 3$                          | 7. $a_n = (2 - n)^6$      | 11. $a_n = \frac{n+3}{2n-1}$  | 15. $a_n = \sqrt[3]{\frac{n+1}{3n+2}}$ |
| 4. $a_n = 3n^2 + 5n$                       | 8. $a_n = n - \sqrt{n}$   | 12. $a_n = \frac{3}{2n+5}$    | 16. $a_n = (1 + \frac{5}{n+1})^5$      |

**47.** Oblicz granicę ciągu  $(a_n)$ , jeśli

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|---|---|--|---|
| 1. $a_n = \frac{4n^2+5n-2}{3n^2-n+6}$             | 5. $a_n = (\frac{2n^2+3n-1}{n^2+5n+2})^2$   | 9. $a_n = (\frac{4n^2+1}{3n^3+2})^3$       | 13. $a_n = \frac{n^4-2n^2+4n+9}{8n^2-3n+1}$   |
| 2. $a_n = \frac{7n^2-3n+2}{5n^2+1}$               | 6. $a_n = (\frac{8n^3+3n+12}{2n^4+2n+1})^3$ | 10. $a_n = (\frac{8n^3+n+2}{3n^4+2n+1})^5$ | 14. $a_n = (\frac{2n^5+n^3+1}{3n^4+n^2-6})^4$ |
| 3. $a_n = \frac{5n^3+n^2+2n-1}{3n^3+2n^2+n+8}$    | 7. $a_n = \frac{-5n^3+n^2-2}{2n^4+n^2+1}$   | 11. $a_n = \frac{6n^3+4n^2-3}{n+4}$        | 15. $a_n = \frac{1+2+\dots+n}{n^2}$           |
| 4. $a_n = \frac{7n^5-3n^3+2n-1}{-9n^5+3n^4-3n^2}$ | 8. $a_n = \frac{2n^4-n^2+2}{n^6-9n^4+3}$    | 12. $a_n = \frac{-n^3+n^2+2}{5n^2+3n+5}$   | 16. $a_n = \frac{n^2+2n-3}{1+2+\dots+n}$      |

**48.** Oblicz granicę ciągu  $(a_n)$ , jeśli

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|---|---|-----------------------------|--|
| 1. $a_n = \frac{\sqrt{4n^2+2}}{3n+1}$     | 4. $a_n = \frac{4n+2}{n+\sqrt{9n^2+4}}$ | 7. $a_n = \sqrt{9n^2-7}-3n$ | 10. $a_n = \sqrt{4n^2+n}-2n$                   |
| 2. $a_n = \frac{\sqrt{9n^2+n+2}+n}{4n+3}$ | 5. $a_n = \sqrt{n^2+3}-n$               | 8. $a_n = \sqrt{4n^2+2}-2n$ | 11. $a_n = \frac{3}{\sqrt{n^2+9}-n}$           |
| 3. $a_n = \frac{\sqrt{n^2+3}+2n}{n+7}$    | 6. $a_n = \sqrt{n^2+3}+n$               | 9. $a_n = \sqrt{n^2+7n}-n$  | 12. $a_n = \frac{-2}{\sqrt{2n^2+4}-\sqrt{2}n}$ |

**49.** Oblicz granicę ciągu  $(a_n)$ , jeśli

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|---------------------------------|---|--|
| 1. $a_n = (1 + \frac{3}{50})^n$ | 4. $a_n = \frac{2^n+4^n}{3 \cdot 2^n+3 \cdot 4^n}$    | 7. $a_n = \frac{2^n-2^{2n}+2^{3n}}{2^n+3 \cdot 2^{2n}-7 \cdot 2^{3n}}$ |
| 2. $a_n = (1 - \frac{1}{30})^n$ | 5. $a_n = \frac{5 \cdot 3^n+9^n}{2^n+4 \cdot 3^{2n}}$ | 8. $a_n = \frac{2^n}{2+2^2+\dots+2^n}$                                 |
| 3. $a_n = (\frac{1}{35} - 1)^n$ | 6. $a_n = \frac{2 \cdot 3^n+5^n}{2^n+3^n-4^n-5^n}$    | 9. $a_n = \frac{1}{3} + \frac{1}{3^2} + \dots + \frac{1}{3^n}$         |

**50.** Oblicz granicę ciągu  $(a_n)$ , jeśli

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|--|--|--|-----------------------------------|
| 1. $a_n = \frac{\sin n}{n}$              | 4. $a_n = \sqrt[n]{5^n + 3^n}$         | 7. $a_n = \sqrt[n]{(\frac{3}{4})^n + (\frac{2}{3})^n}$ | 10. $a_n = \sqrt[n]{7n+9}$        |
| 2. $a_n = \frac{(-1)^n}{2n-1}$           | 5. $a_n = \sqrt[n]{3^n + 2^n + 1}$     | 8. $a_n = \sqrt[n]{(\frac{1}{3})^n + (\frac{1}{4})^n}$ | 11. $a_n = \sqrt[n]{5n^2 + 3n^5}$ |
| 3. $a_n = \frac{\sqrt[3]{n} \sin n!}{n}$ | 6. $a_n = \sqrt[n]{3 \cdot 2^n + 3^n}$ | 9. $a_n = \sqrt[n]{5n+3}$                              | 12. $a_n = \sqrt[n]{3 + \sin n}$  |

**51.** Oblicz granicę ciągu  $(a_n)$ , jeśli

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|-----------------------------------|-----------------------------------|--|--------------------------------------|
| 1. $a_n = (1 + \frac{2}{n})^n$    | 4. $a_n = (\frac{n+3}{n})^{5n-2}$ | 7. $a_n = (\frac{n^2+6}{n^2})^{n^2}$     | 10. $a_n = (\frac{3n+5}{3n})^{3n+2}$ |
| 2. $a_n = (1 + \frac{3}{n})^n$    | 5. $a_n = (\frac{n-4}{n})^{3n+1}$ | 8. $a_n = (\frac{n^2+3}{n^2+2})^{n^2+1}$ | 11. $a_n = (\frac{2n-3}{2n})^{4n+7}$ |
| 3. $a_n = (\frac{n+2}{n})^{5n+4}$ | 6. $a_n = (\frac{n-7}{n})^{2n-3}$ | 9. $a_n = (\frac{2n+5}{2n})^{4n+3}$      | 12. $a_n = (\frac{3n-2}{3n})^{n-4}$  |