Part A: Evaluate each expression

20. $\int_0^\infty \frac{e^{-x}}{x^{\frac{3}{2}}} dx$

26. $\text{cof}_{42} \begin{bmatrix} 2 & -2 & 5 & 4 \\ 3 & -1 & 4 & 2 \\ -3 & 0 & -3 & 1 \\ 1 & -4 & 2 & -2 \end{bmatrix}$

35. $[\mathbf{V}_1\mathbf{V}_2\mathbf{V}_3]$ where $\mathbf{V}_1 = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}$, $\mathbf{V}_2 = \begin{bmatrix} -1 \\ 2 \\ 2 \end{bmatrix}$, $\mathbf{V}_3 = \begin{bmatrix} -1 \\ -2 \\ -3 \end{bmatrix}$

37. $e^{\pi e^{(i\pi)/2}}$

46. $\int \frac{dx}{1+e^x}$

52. $\sum_{n=0}^{\infty} \frac{(-1)^n}{n+1}$

Part B: Physics

17. $\epsilon/(dI/dt)$

19. $(\mathbf{E} \times \mathbf{B})/\mathbf{S}$

28. $Y_0^0(\theta, \phi)$

44. $[P, X]$

53. $< -|- >$

55. $\frac{\int (\mathbf{F} \cdot \mathbf{dl})}{W}$

Part C: Chemistry

16. What is ΔH - TΔS for a spontaneous process?

24. $^{264}\text{Bh} \rightarrow {}^{260}\text{Db}$

32. $^{97}\text{Y} \rightarrow {}^{97}\text{Zr}$

40. Standard reduction potential of $\text{N}_2(g)$ + 4 $\text{H}_2\text{O}(l)$ + 4 e^- → 4 $\text{OH}^-(aq)$ + $\text{N}_2\text{H}_4(aq)$

48. $\Delta\text{H}_f^\circ(\text{N}_2\text{H}_4(g))$

56. $(\text{CH}_3)_4\text{B}$

Part D: Mathematics

21. Imagine a game with a pair of fair dice. You begin with a score of zero. Each time you toss the dice, add the total to your score if it is prime, otherwise subtract the total from your score. What is your expected score after 9 throws?

27. Find the inverse Laplace transform of $\frac{1}{s+s^3}$

33. What is the 6th term in the Taylor expansion of $\sin(x)$ at 0?

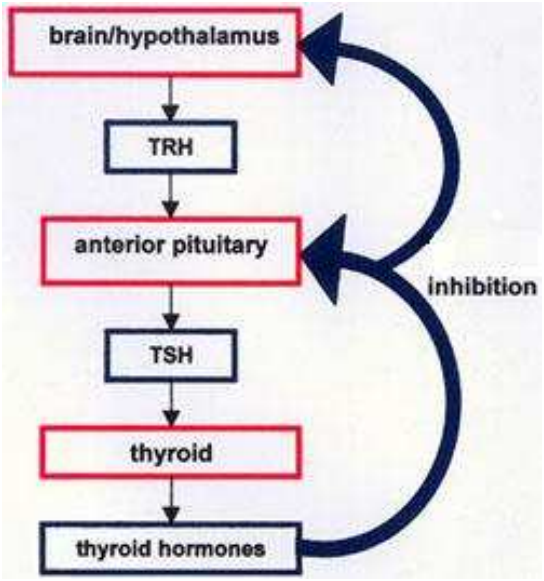
39. Find the real roots of $x^4 + 2x^3 - 11x^2 - 2x + 40 = 0$

45. Find the eigenvalues of the system $dx/dt = y - 2x; dy/dt = x - 2y$

51. What is the fourth perfect number?

Part E: Biology

18. What is this?



23. What voltage causes no net flow of potassium ions in a cell in the human body when the outer concentration is 5 mM and the inside concentration is 140 mM?

31. What is this?

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TTACTTCAAGCTGAACATCATCCGCCCACACACGACGACTCCAACGATTCCAATGGCTCCAGCTGTTACT
CCAGCGCCAATCATCGACCACCGTCTGTTCTGCTTCCGGCGTCCCACTTTTTCAGCTTCTGCTCGTTCGT
AGTCCTCTTTCATTTGTTTTCCGAGTGTCATGAAGTCGTCCTGCAATTTTTTTCTTGATTTTTTATTTTC
ACAAATAATGCTTTAGAGCATATTCCGGGGAACACAAAAATCCGTGAATGCGTATTTCACAACATATTTG
AGGCGGAAATATCTCGTAGCGAAAACTACAGTAATTCTTTAAATGCCTACTGTAGTCGATTTACGGGCTC
GATTTTTGAAATTAATTTCTTTTGATTAGTGGTTATTTTCTTTAATTGTAAAAATTTTAAAAATTTAAAG
AATTACTGTAGTTTTCTCTACTGGATATTTTGCGCGTCAAATATGTTGTGAAATAGCATTCTGCGAATTT
TGTATTCCCGTAACAATAACATTATCATAAACAGTAATATACTTGAATATGTTTCCAGCTGTCCCCCCAA
GAGGCTACCGAACCCTGTAATTATCGGCTTACCAACACCCCGGGAAGTCAAGGGTACTAGGGAAAGGGGG
ATATTGACTTCTAATGTCTATGCAAATACTCCTTACCCAGCTCCGATTGTGTTCCTTCCAGTTGTTGCGG
ATCCGCGTTTTGATGAACAGCGATGTGTAAACGAAGAGGTTTCGCACTTGTCCCTGCAGTTCCACGGATT
CCATCATTTTTGCAGCTACGAAACCGCCGAACGAGATTAGACCTATCTGAAAATTAGAAATTTGCAATTT
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AATTCGTTCATTTCTGGCGGAAAATTAAGCTTAAAAAAACGATTTTTCTGGTTTTTAATGTTCGAAAATT
GAATTTTTGGGGTTTTTCGTTCAGCAAATCAGCAGAAAAACCTGTTTTTCGAAGAAAAAAGTTCAAAAAT
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CGCAAATACAAATCAAGGAAAATATGCTTTAAAAATATTCGAATAGAAAATAACGTTTTTAATCGAATTC
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AAACAATTTTTGCAAATGTTTTTTCTGCCACCTTTCTGGCGAATTTTCGAATTTTTGCAAACTTTTTTTC
AGTATTTTCTCCCTTACCAAACGTCCATAAGACATTGGACATTGATCTGTCTGTGCATTTCCAACCGTCC
GAACCACATCCTGATACAGTGAAAATGAGATTCTGGGCACTGCGAGCAGCTGCTCACAGAAGGTCTCAAA
ATTTTCCGCGTGCTTCTTCTCGAATATCGTTCCCATAACTCGCATCATTTCGTGCTCCGGTTGCACTCCA
CACGGCAATCCCGGTGCTCCAAACCATTCCATTCCGTTTTGCCGGATTCGGTGCGTGAAATAGTCGACCT
GGAAGCAGCAGGAAATTTTATTTACAAAAAAAAATTAAAAAATTACCACAAATCCCTCGATATCAAGCCT
TGGCTCTTCCCAATCATTGATTTTTCCATCAATTGACTCTCCGATGGACATTCTTCGCGTCGAAGCCTGC
CTACTCGGTGATGGCAAGTCCTGAGCATCACTATTGATTCCAAAATCGGTGGGCTCTGTGCCTTTTATCC
CCAGAAACTCCTTCATCTCGCCAGTCGCCATCGTTCGTCGCCGATACGCCGGATTCGTCAGCGAGTTGTC
CGCCGTGCAGCGTGTCAT
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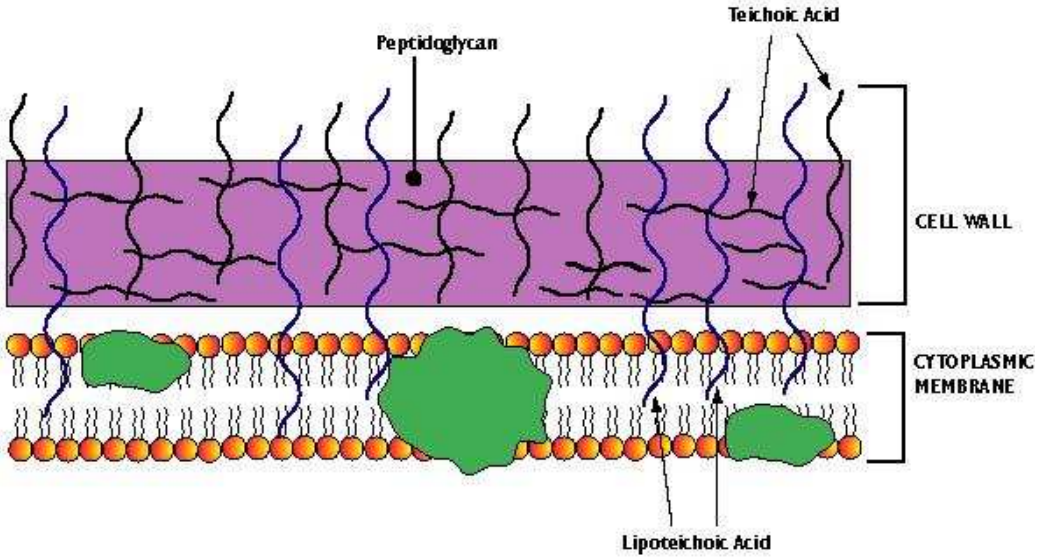
41. A certain species of gremlins has purple skin with orange polka-dots. Gremlins homozygous for a loss-of-function allele of the ac_me gene have white skin, while heterozygotes for this allele have normal skin color. You do your own mutagenesis screen and isolate a mutation in ac_me that, when homozygous, has white skin. You cross your homozygous mutant strain to a wildtype strain, and all the gremlins in the F1 have white skin. What kind of mutation have you most likely isolated?

49. A closed circular DNA molecule 5000 base pairs long, 10.6 base pairs per turn, with a linkage number of 471, exhibits what kind of supercoiling?

54. What is this?



Part F: Linguistics

25. What property is shared by [ɪ] and [ɛ] but not [e]?

30. What is restricted to monotone downward-entailing contexts?

34. What is the electrical response to a semantic anomaly?

38. What is the ToBI diacritic denoting an intermediate phrase boundary tone?

42. What is Chomsky's (1957) symbol denoting the concatenation operator on the level of phrase structure?

47. What is the value of [aug] for Jemez nouns that take Inverse marking when singular?