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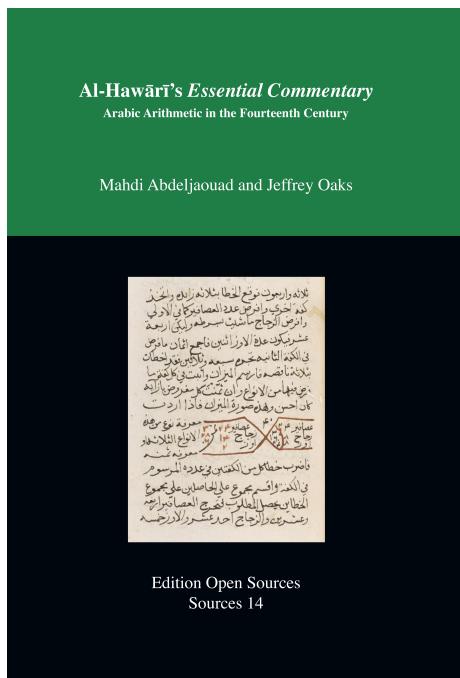
Mahdi Abdeljaouad and Jeffrey Oaks:

Al-Hawārī's *Essential Commentary*
Arabic Arithmetic in the Fourteenth Century

Mahdi Abdeljaouad and Jeffrey Oaks

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D. Glossary

For each Arabic word, we give references to the text, and thus also to the translation. References to explanations of the word or concept in our commentary are preceded by a "C". For words that were used in both technical and non-technical ways, we include references to both. The listing follows the alphabetical order of the roots of the words.

ا

آحاد   *āḥād*: units, 65.2, 65.8, 68.19, 69.3, 16. C65.2.

اس   *uss*: 1. index, 70.15, 71.12, 101.19, 107.12. C68.18.
2. power, 225.1, 8, 226.3, 227.15, 229.19. C68.18.

الا   *illā*: less, 76.19, 86.11, 140.2, 173.18, 219.5. C141.7, C173.10, C219.4.

امام   *imām*: denominator, 94.12, 120.1, 135.12, 138.1, 170.10, 206.6. C93.6.

اول   *awwal*: prime, 66.7. C66.7.

ب

بسط   *basaṭa*: to numerate, 93.3, 134.1, 138.5, 145.9. C93.10.

بسط   *basṭ*: numerator, 93.17, 137.13, 139.10, 142.8, 170.10. C93.10.

مبسوط   *mabsūṭ*: numerator, 144.6, 145.3, 151.2, 158.7. C93.10.

بسيط   *basīṭ* (and related forms): simple, 66.9, 67.17, 69.15, 134.2, 217.8. C66.7.

مبعض   *mubʿʿiḍ*: portioned, 137.1, 139.10.

بقي   *baqiya*: to leave, remain, 72.2, 85.5, 88.10, 113.4, 165.1, 229.19. C83.1.

باقي   *bāqī*: remainder, 72.7, 84.12, 90.9, 141.6, 176.2, 201.4, 216.2, 220.2, 231.6. C83.1.

بقية   *baqiya*: residue, 89.2, 90.5, 91.13, 92.6. C83.1.

باقية   *bāqiya*: residual, 92.1, 12, 93.12. C83.1.

متباينة   *mutabāyna*: 1. different (i.e., relatively prime), 122.13, 123.11. C122.2.
2. incommensurable, 180.11, 182.5. C173.10.

ث

مستثنى   *mustathnā* (and related forms): excluded, 137.12, 140.1, 142.11, 183.17, 220.5, 230.1. C140.1, C173.10, C219.4.

مستثنى منه   *mustathnā minhu* (and related forms): diminished, 140.14, 141.3, 230.1. C140.1, C173.10, C219.4.

<div dir="rtl">ج</div>

جبر   *jabara*: to restore, 129.6, 154.7, 217.3, 223.9. C129.1, C211.2, C219.4, C223.1.

مجبور   *majbūr*: number to be restored, 129.8, 154.2.

مجبور اليه   *majbūr ilayhi*: restored number, 129.8, 154.2.

الجبر   *al-jabr*: 1. restoration, 129.1, 154.1, 211.1,2, 217.5, 220.11. C129.1, C211.1, C220.5.
2. algebra, 183.19, 189.3, 211.8. C191.1, C211.1.

الجبر والمقابلة   *al-jabr wa l-muqābala*: algebra, 191.4, 209.2. C191.1, C211.1, C223.1.

جذر   *jadhr*: 1. root (square root), 66.18, 68.12, 163.5, 173.5, 180.7, 187.11, 213.8,11, 214.12, 216.22. C213.7.
2. root (unknown in algebra), 211.9,15, 212.8, 214.14, 215.12, 216.20. C213.7.

مجذور   *majdhūr*: has a root, 66.17, 164.2. C66.13.

مجذورة   *majdhūra*: has a root, 163.14, 166.14. C66.13.

جزأ   *jazaʾa*: to partition, 184.10, 186.8. C65.2, C179.1, C186.8.

جزء   *juzʾ*: 1. part, 61.9, 94.11, 95.8, 117.2, 121.1, 127.2, 131.1, 134.6, 152.6, 172.2. C131.1. See also *ajzāʾ ṣumm* and *ajzāʾ muḥāṣṣa*.
2. portion, 198.5, 199.4, 200.5, 202.1, 203.5.

اجزاء   *ajzāʾ*: parts (from Euclid), 133.1. C131.1.

جمع   *jamaʿa*: to add, 74.9, 86.15, 100.2, 134.8, 179.2, 201.11, 219.5. C73.2.

جمع   *jamʿ*: addition, 73.1, 74.1, 80.20, 147.4, 176.11, 219.1.

مجموع   *majmūʿ*: 1. sum, 71.20, 80.15, 100.3, 173.8, 198.17, 226.10. C73.2.
2. addend, 74.18, 75.15, 76.5, 91.9, 179.11, 180.7.

مجموع اليه   *majmūʿ ilayhi*: augend, 74.18, 91.9, 147.6, 180.7.

جملة   *jumla*: sum, 79.6, 109.8. C73.2.

جنس   *jins*: species, 104.16, 105.4, 219.2, 220.1, 221.16; type, 117.9, 134.6; kind, 195.14, 211.3,6. C68.18.

<div dir="rtl">ح</div>

حرف   *ḥarf*: 1. letter, 88.12, 89.1,6. C68.18.
2. particle, 142.2, 173.16, 182.5, 220.1. C68.18.
3. conjunction, 142.10, 173.14, 180.11, 181.2. C68.18.

محسوسة   *maḥsūsa*: sensible, 133.6. C133.3.

محاصة   *muḥāṣṣa*: apportionment, 120.20. C120.20.

اجزاء محاصة   *ajzāʾ muḥāṣṣa*: apportioned parts, 121.1, 122.2. C120.20.

حط   *ḥaṭṭa*: to reduce, 129.7, 155.13, 217.1. C129.1, C217.1.

حط   *ḥaṭṭ*: reduction, 129.1, 154.1, 217.5. C129.1, C217.1.

محطوط   *maḥṭūṭ*: number to be reduced, 129.12, 154.4, 155.14.

محطوط اليه   *maḥṭūṭ ilayhi*: reduced number, 129.12, 154.2, 155.14.
حل   *ḥalla*: to decompose, 68.15, 117.16, 120.1, 123.4. C68.11.
حل   *ḥall*: decomposition, 68.15, 117.2, 122.9.
حمل   *ḥamala*: to add, 71.18, 84.17, 108.10, 167.12, 200.4, 214.7, 216.11. C73.2.

خ

مختلف   *mukhtalif*: distinct, 136.8, 137.12, 139.1, 142.7, 145.14. C93.15, C136.8, C139.1.
مختلفة   *mukhtalifa*: difference, 73.20.

د

درهم   *dirham*: 1. dirham (unit of currency), 95.10, 117.16, 158.2, 207.7. C211.8.
2. dirham (unit in arithmetic/algebra), 219.3, 220.3, 221.13, 223.7, 228.3. C211.8.
ادق   *adaqq*: finer, 94.11, 135.8, 136.7, 158.10.

ذ

ذهب   *dhahaba*: to take away, 169.12, 199.1. C83.1.

ر

ربع   *rabaʿa*: to square, 80.5, 112.17, 113.14, 214.7, 215.8, 232.3.
مربع   *murabbaʿ*: square, 66.17, 112.17, 164.17, 173.4, 211.10. C66.17.
تربيع   *tarbīʿ*: squaring, 79.18, 80.10, 112.16.
مرتبة   *martaba*: rank, 65.1, 68.18, 74.22, 174.2, 180.6, 230.14. C68.18, C174.1.
رد   *radda*: transform, 143.1, 180.1,6, 184.9, 188.2, 228.8. C179.20.
ركب   *rakiba*: 1. to compose (numbers), 122.13, 123.5. C66.7, C68.11.
2. to combine (a proportion), 121.23, 196.17, 204.2. C196.16.
مركبة   *murakkaba* (and related forms): 1. composed; composite; composition (numbers), 66.12,16, 68.1, 120.1, 127.4,12, 128.2. C66.7.
2. composite (equations), 211.14, 212.6, 217.1. C211.13, C219.4.

<div dir="rtl">ز</div>

زوج   *zawj*: even, 65.6.

زوج الزوج   *zawj al-zawj*: evenly-even, 65.12. C65.10.

زوج الفرد   *zawj al-fard*: evenly-odd, 65.17. C65.10.

زوج الزوج والفرد   *zawj al-zawj wa l-fard*: evenly-evenly-odd, 66.1. C65.10.

زاد   *zāda*: 1. to add, 71.13, 110.2, 113.17, 175.7, 204.19, 220.10. C73.2.
2. to exceed, 77.6, 108.9, 169.12. C73.2.

زائد   *zāʾid*: 1. appended, 87.11, 183.19, 189.3, 211.5, 228.9. C219.4.
2. exceeds, 198.15, 200.6, 201.9, 203.5. C219.4.

زيادة   *ziyāda*: added; additional; excess, 77.7, 108.13, 115.5, 200.6.

<div dir="rtl">س</div>

مسطح   *musaṭṭaḥ*: 1. surface (in arithmetic), 67.3, 80.10, 182.5, 225.6, 231.14. C66.17.
2. surface (in geometry), 133.7. C66.17.

سقط   *saqaṭa*: to drop, 76.13, 109.17, 123.4, 140.11, 166.17, 175.13, 199.4, 216.18, 231.4. C83.1.

اسم   *ism*: 1. name, 59.1, 66.13, 67.16, 69.15, 71.6, 134.1, 157.9, 229.5. C68.18.
2. term, 173.5, 174.5, 176.1, 211.12, 217.2, 225.1, 229.15.

ذو الاسمين   *dhū l-ismīn*: binomial (lit., "two unified names"), 173.13, 175.11, 180.13, 188.18. C173.10.

سمى   *sammā*: to denominate, 94.1, 108.9, 121.15, 166.9, 181.16, 187.1. C93.6.

تسمية   *tasmiya*: denomination, 93.6, 109.7, 118.15, 151.1. C118.14.

مسمى   *musammā*: denominated number, 94.3, 124.8, 153.5. C93.6.

مسمى منه   *musammā minhu*: denominating number, 93.6, 123.18, 153.5, 181.18. C93.6.

<div dir="rtl">ش</div>

اشتراك   *ishtirāk*: common divisor, 122.4, 146.3, 153.10, 230.11. C122.2.

شيء   *shayʾ*: thing, 211.8, 213.7, 219.10, 225.2, 227.20. C211.8.

<div dir="rtl">ص</div>

صحيح   *ṣaḥīḥ*: 1. whole; whole number, 61.10, 65.2, 92.15, 149.2, 154.10, 163.1, 207.10.
2. posited number, 198.14, 199.14, 200.10, 201.10. See footnote in translation at 198.14.

صرف ṣarafa: to convert, 157.10, 158.9. C157.1.

صرف ṣarf: conversion, 95.8.

مصروف masrūf: fraction to be converted, 158.7,12, 159.1.

مصروف اليه masrūf ilayhi: converted fraction, 158.1,8,12.

تصفير taṣfīr: voiding, 114.7. C74.17.

صفر ṣifr: zero, 69.9, 75.5, 84.1, 98.22, 112.8, 114.4, 119.13, 170.8. C74.17.

اصم aṣamm: deaf (i.e., prime), 127.5,14, 128.12. C66.7, C134.2.

اجزاء صم ajzāʾ ṣumm: deaf parts (i.e., prime), 66.9, 126.2, 127.9, 128.12. C134.2.

صنف ṣanf: kind, 207.8, 208.8. C68.18.

ض

ضرب ḍaraba: to multiply, 71.13, 95.10, 96.3, 129.3, 183.2, 211.11, 226.9.

ضرب ḍarb: 1. multiplication, 92.8, 95.1, 98.4, 103.18, 157.11, 225.1, 227.6. C95.2, C149.2, C183.4, C225.1.
2. variety, 65.6, 66.15, 67.17; type, 73.3,10, 83.2, 170.14, 211.1,14, 214.3, 223.6; kind, 95.15, 98.4. C68.18.

مضروب maḍrūb: 1. multiplicand, 92.12, 95.4, 96.4, 99.17, 102.4, 149.4, 226.9.
2. multiplication, 93.3, 98.9.

مضروب فيه maḍrūb fīhi: multiplier, 92.12, 95.4, 96.4, 101.1, 103.4, 149.4, 226.9.

ضعف ḍaʿafa: to duplicate, 149.5, 186.1.

تضعيف taḍʿīf: duplication; duplicating, 95.2,5, 114.7, 149.2, 184.10, 186.1. C74.17, C95.2, C149.2, C179.1, C186.1.

ضلع ḍilʿ: side, 66.18, 67.2,13, 68.9,12. C66.17.

ضاف ḍāfa: 1. to add, 97.15, 102.6, 105.3, 110.10, 215.18. C73.2.
2. to attach, 124.5, 135.1, 144.4.

مضاف muḍāf: combined, 137.14. C137.13.

ط

طرح ṭaraḥa: 1. to subtract, 76.4, 83.7, 84.2, 147.1, 179.1, 211.3, 220.1, 221.1. C83.1.
2. to cast out, 87.18, 88.1, 91.2, 125.16.

طرح ṭarḥ: 1. subtraction, 83.1, 91.12, 147.3, 176.11, 211.7, 219.1. C83.1,2, C219.4.
2. modulus, 91.13, 125.6, 126.3, 127.1.

مطروح maṭrūḥ: subtrahend, 83.6, 86.15, 148.1, 182.1, 220.13.

مطروح منه maṭrūḥ minhu: minuend, 83.6, 86.4, 91.12, 148.1, 220.10.

منطرحة munṭariḥa (and related forms): cast out entirely, 87.22, 88.6, 125.8,9, 126.1, 127.1.

مطلوب maṭlūb: required number, 76.14, 101.14, 147.12, 171.3, 198.18, 220.17, 228.13, 231.12.

<div dir="rtl">

ع

عد   *ʿadda*: to count, 66.8, 127.11, 128.1,12, 166.1. C127.9.

عدد   *ʿadad*: number, 61.9, 65.2, 68.18, 69.15, 71.13, 73.2, 133.1, 163.3, 170.7, 173.13, 211.8. C65.2, C219.1.

عدة   *ʿidda*: number, 79.1,3,10.

عدل   *ʿadala*: to equal, 211.13,15, 216.13, 223.2, 227.14, 227.16, 228.1. C211.13, C213.7.

معادلة   *muʿādala*: 1. equation, 217.2,4, 227.16,18, 228.2. C213.7. 2. equalization, 211.5, 220.11, 221.8. C213.7.

متعادلان   *mutaʿādilān*: two sides of [the] equation, 220.8, 223.1.

عقد   *ʿaqd*: power of ten (lit., "bent finger-joint"), 87.17, 109.19, 110.7, 111.3. C110.5.

معقول   *maʿqūl*: intelligible, 133.6. C133.3.

علة   *ʿilla*: cause, 87.11.

على   *ʿalā*: to surpass, 121.6. C73.2.

معنى   *maʿnā*: meaning, 68.12, 94.12, 95.5,9,11,13, 113.2, 117.9, 211.1, 213.8. C95.3.

غ

غربال   *ghirbāl*: sieve, 127.10. C127.9.

ف

فرد   *fard*: odd, 65.6.

مفرد   *mufrad* (and related forms): simple, 109.20, 137.13, 211.14, 213.2. C137.13, C211.13.

منفصلة   *munfaṣila*: detached, 141.9, 142.8,13. C141.7.

منفصل   *munfaṣil*: 1. apotome, 173.4, 173.16, 176.4,18, 182.9, 188.18. C173.10. 2. discrete, 117.4, 133.8. C117.2, C133.3.

فضل   *faḍala*: to exceed, 78.1,7. C73.2.

فضل ما بين   *faḍl mā bayna*: difference between (sometimes just *mā bayna* or *faḍl bayna*), 78.2, 111.21, 173.9, 197.1, 201.1, 204.14, 229.5.

تفاضل   *tafāḍul* (and related forms): disparity, 73.7,15, 76.7, 79.1.

ق

قبل   *qabila*: 1. to confront, 198.10, 199.5, 207.3, 217.7, 221.19, 223.9. C223.1. 2. to match, 99.18.

مقابلة   *muqābala*: confrontation, 199.6,12, 211.3, 221.8. C211.1, C220.5.

قدر   *qadr*: size (of a ratio), 124.6.

تقريب   *taqrīb*: approximation, 166.12, 168.6, 169.1, 173.2.

</div>

قسم   *qasama*: to divide, 61.10, 65.2, 72.1, 93.10, 117.16, 118.1, 119.18, 151.4, 187.2, 189.1, 229.2,12,16, 230.13. C117.2.

قسم   *qism*: 1. kind, 65.2, 73.6; type, 82.1, 95.3, 157.11; variety, 163.2. C68.18.
2. part, 118.8, 139.1, 144.8, 202.4,10.

قسمة   *qisma*: division, 72.1, 117.2, 118.14,15, 120.20, 151.4, 188.18, 229.6. C68.18, C95.2, C117.2,9, C118.14, C230.11.

مقسوم   *maqsūm*: dividend, 93.14, 117.8, 119.2, 151.5, 152.14, 187.3, 229.2,14. C93.6.

مقسوم عليه   *maqsūm ʿalayhi*: divisor, 93.6, 117.2, 118.4,18, 119.7, 151.5, 181.15, 188.7, 229.3,18. C93.6.

منقطع   *munqaṭiʿ*: disconnected, 140.1,18, 143.1. C140.1.

قانون   *qānūn*: basic rule, 170.7, 191.1.

قوة   *quwwa*: area (lit., "power"), 177.8,14. C163.4, C177.5. See also *munṭaq fī l-quwwa* below.

مقام   *maqām*: denominator, 122.15, 171.2. C93.6.

قياس   *qiyās*: rule, 175.18, 183.10, 184.7, 187.18.

<div align="center">ك</div>

كسر   *kasr*: fraction, 65.2, 93.15, 133.4, 134.1, 135.10, 143.5, 154.6, 157.4, 170.10. C65.2, C131.1, C133.3, C134.2.

مكعب   *mukaʿʿab*: cube, 67.12,15, 68.14,15, 74.1, 80.2. C67.12, C211.8.

كعب   *kaʿb*: 1. cube root, 67.13,16, 68.9,12. C67.12.
2. cube (the third power in algebra), 221.1, 225.2,13, 226.7, 227.10, 229.8. C67.12, C211.8.

كم   *kamm* (and *kammīya*): quantity, 73.17, 93.5. C73.17, C92.17.

كيف   *kayf* (and *kaifīya*): quality, 73.7, 93.5. C73.17, C92.17.

<div align="center">ل</div>

لفظ   *lafẓ*: 1. term, 95.5,8,11,13, 184.9, 188.1. C95.3.
2. word, 70.3, 73.24, 117.11.

<div align="center">م</div>

مال   *māl*: 1. quantity, 199.1,19, 200.1, 201.1, 203.13, 213.8,14, 215.7. C211.8.
2. *māl* (the second power in algebra), 211.8,15, 213.7, 214.9, 215.12, 225.4,8, 226.1. C211.8.

ن

نزل   *nazala*: to remove, 114.8, 123.1, 142.2, 146.3, 221.5. C83.1.

منزلة   *manzila*: place, 69.1,17, 71.8,19, 76.18, 83.10, 90.4, 112.6, 164.1. C68.18.

نسبة   *nisba*: 1. ratio, 73.8, 78.4, 108.10, 113.10, 117.5, 123.21, 124.6, 133.3, 163.3, 195.7. C131.1, C133.3, C193.1.
2. proportion, 121.23, 191.4, 195.2. C193.1, C195.2.

نسبة عددية   *nisba ʿadadiyya*: arithmetic progression, 73.17, 74.5.

نسبة هندسية   *nisba handasiyya*: geometric progression, 73.7, 78.13. C73.17.

منتسب   *muntasib*: related, 135.10, 138.1, 139.4. C135.1,10.

منطق   *munṭaq*: rational (lit., "expressible" in speech), 163.2, 167.9, 172.10, 174.2, 177.8, 183.10. C134.2.

غير منطق   *ghayr munṭaq*: surd (lit., "inexpressible"), 163.2,4,6. C163.2.

منطق في القوة   *munṭaq fī l-quwwa*: rational in square (lit., "expressible in power"), 163.7, 180.7, 188.7. C163.4.

نقص   *naqaṣa*: to subtract, 112.9, 168.14, 173.6, 183.16, 204.10, 215.4, 232.8. C83.1.

ناقص   *nāqiṣ*: 1. deleted, 87.11, 189.3, 211.5, 220.10, 228.9. C219.4.
2. falls short, 198.12, 199.7, 202.7, 205.19. C219.4.

تنقيل   *tanqīl* (and related forms): shifting, 95.16, 97.3, 98.8, 99.14, 157.7.

منتهى اليه   *muntahā ilayhi*: upper extreme, 79.13, 80.5,20, 81.2, 82.2.

نيف   *nāfa*: excess, 108.9.

نوع   *nawʿ*: species, 65.10, 66.7, 71.13, 211.3,8, 220.5, 226.9; kind, 66.16, 67.18, 157.2, 158.1, 195.2; type, 92.15, 97.1, 99.14, 118.14, 207.9. C68.18.

و

و   *wa*: and, C219.1.

موسط   *muwassaṭ* (and *mutawassiṭ*): medial, 163.8, 176.14, 180.8, 187.10, 188.7. C163.4.

موسطين   *muwassaṭayn*: bimedial, 176.13,18, 177.14. C176.10.

وصل   *waṣala*: to join (i.e., form a binomial), 174.15, 175.1,3,5,7,9. C173.10.

متصل   *muttaṣil*: 1. continuous, 117.6. C117.2, C133.3.
2. connected, 140.14,16, 141.9, 143.1. C140.14.
3. joining, 177.9,15. C173.10.
4. binomial (lit., "joining"), 188.19,20, 189.12,14. C173.10.

متصلة   *muttaṣila*: connected, 142.2,8,11. C140.14.

موضع   *mawdhiʿ*: place, 108.12, 109.5. C68.18.

وفق   *wafiqa*: to reconcile (i.e., cancel common factors), 120.3,17, 123.1,5. C119.18.

على توالي   *ʿalā tawālī*: consecutive; consecutively, 79.13, 15, 80.2, 5, 81.16, 89.6.