EASYSEXTANT

Training material for sight reduction with Sun observations.

Manual calculation of intercept and Sun azimuth

8 exercises with solutions:

1. La Rochelle
2. Madagascar
3. Perth
4. San Francisco
5. Galapagos
6. Tokyo
7. Pointe-a-Pitre
8. Rotterdam

INSTRUCTIONS

The greyed-out values, determined by the navigator, include the Greenwich Hour Angle (GHA) of the Sun and the declination (D) at the hour, taken from the nautical almanac.

The calculation then proceeds to determine intercept and Sun azimuth.

Hs = 20°19',2

ε = 4',2

Dip = - 2',5 +

Ha = 20°20',9

sun correct. LL/UL = +13',6 +

Ho = 20°34',5

La Rochelle

Date 26/01/2022

UT 10h 40m 19s

index error = + 3'

\+ *non adjust.error* = + 1',2

ε = + 4',2

L = 46°12' N

G = 004°31' W

Height of the eye = 2 m

☒ *lower limb* ☐ *upper limb*

GHA = 326°52',8

\+ *pp* = 10°04',8 (increment)

GHA = 336°57',6

G = 004°31' W G = East→ add

LHA = 332°26',6 G = West→ subtract

LHA < 180° ; sun in the **W**est ; *P* = *LHA*

LHA > 180° ; sun in the **E**ast ; *P* = 360 − *LHA*

P = 27°33',4 ☒NE / ☐ NW / SE☐ / ☐SW

(d ↑ *or* ↓ = 0',6 ↓)

D = 18°40',1 S

correc. d = 0',4

D = 18°39',7 S

L = 46°12' ⇒

D = 18°39',7

(L/D) = 64°51',7 ⇒

(T1) LOG COS L = 9,8402

(T1) LOG COS D = 9,9765

(T2) LOG VERSINE P = 9,0548 +

LOG 2e T = 28,8715

(T3) COS (L/D) = 0,4248

(T4) NAT 2e T = 0,0745 —

SIN Hc = 0,3503

(T3) Hc = 20°30',3

Ho = 20°34',5

Hc = 20°30',3 —

intercept = 4',2 (+ ou -)

L et D **same** name

→ (L - D) or (D - L)

L et D **not same** name

→ (L + D)

Bataille Azimuth (T5)

m = − 0.64

n = − 0.24

m+n = − 0.88

Z = 27.5° **Zv = 152,5°**

Z → Zv	*Latitude North*		*Latitude South*	
	m + n > 0	*m + n < 0*	*m + n > 0*	*m + n < 0*
LHA > 180° morning	Zv = Z	Zv = 180 – Z	Zv = 180 – Z	Zv = Z
LHA < 180° afternoon	Zv = 360 – Z	Zv = 180 + Z	Zv = 180 + Z	Zv = 360 – Z

Hs = 50°43',8

ε = - 2',2

\+ Dip = - 3 ',6 +

Ha = 50°38,0'

+ sun correct. LL/UL = +15',4 +

Ho = 50°53',4

Madagascar

Date 05/02/2022

UT 11h 55m 29s

index error = - 4'

\+ *non adjust.error* = + 1',8 +

ε = - 2',2

L = 30°24' S

G = 044°13' E

Height of the eye = 4 m

☒ *lower limb* ☐ *upper limb*

GHA = 341°30',6

+ pp = 13°52',3 increment)

GHA = 355°22',9 G = West→ subtract

G = 044°13' E G = East→ add

LHA = 039°35',9

LHA < 180° ; sun in the **W**est ; *P* = *LHA*

LHA > 180° ; sun in the **E**ast ; *P* = 360 − *LHA*

P = 039°35',9 ☐ NE ☒ NW ☐ SE ☐ SW

(d ↑ *or* ↓ = 0',8 ↓)

D = 15°51',4 S

corr. d = 0',7

D = 15°50',7 S

L = 30°24' ⇒

D = 15°50',7 +/-

(L/D) = 14°33',3 ⇒

(T1) LOG COS L = 9,9358

(T1) LOG COS D = 9,9832

(T2) LOG VERSINE P = 9,3607 +

LOG 2e T = 29,2797

(T3) COS (L/D) = 0,9679

(T4) NAT 2e T = 0,1904 —

SIN Hc = 0,7775

(T3) Hc = 51°02'

Ho = 50°53',4

Hc = 51°02',0 —

intercept = -8',6 (+ ou -)

L et D **same** name

→ (L - D) or (D - L)

L et D **not same** name

→ (L + D)

Bataille Azimuth (T5)

m = − 0.38

n = + 0,25

m+n = − 0.13

Z = 78,5° **Zv = 281,5°**

Z → Zv	Latitude North		Latitude South	
	m + n > 0	*m + n < 0*	*m + n > 0*	*m + n < 0*
LHA > 180° morning	Zv = Z	Zv = 180 – Z	Zv = 180 – Z	Zv = Z
LHA < 180° afternoon	Zv = 360 – Z	Zv = 180 + Z	Zv = 180 + Z	Zv = 360 – Z

Hs = 36°54',1

ε = 2',7

Dip = - 2',5 +

Ha = 36°54',3

+ *sun correct.* LL/UL = - 14',7 +

Ho = 37°09',0

Perth

Date 16/08/2022

UT 07h 14m 35s

index error = +1'

\+ *non adjust.error* = + 1',7 +

ε = 2',7

L = 27°25' S

G = 106°39' E

Height of the eye = 2 m

☒ *lower limb* ☐ *upper limb*

GHA = 283°54',8

+ *pp* = 3°38',8 increment)

GHA = 287°33',6 G = West→ subtract

G = 106°39' E G = East→ add

LHA = 034°12',6

LHA < 180° ; sun in the West; $P = LHA$

LHA >180° ; sun in the East; $P = 360 - LHA$

P = 034°12',6 ☐ NE ☐ NW ☐ SE ☒ SW

(d ↑ *or* ↓ = 0',8 ↓)

D = 13°42',9 N

corr. d = 0',2

D = 13°42',7 N

L = 27°25' ⇒

D = 13°42',7 +/-

(L/D) = 41°07',7 ⇒

(T1) LOG COS L = 9,9483

(T1) LOG COS D = 9,9874

(T2) LOG VERSINE P = 9,2381 +

LOG 2e T = 29,1738

(T3) COS (L/D) = 0,7532

(T4) NAT 2e T = 0,1492 —

SIN Hc = 0,6040

(T3) Hc = 37°09',5

Ho = 37°09',0

Hc = 37°09',5 —

intercept = -0',5 (+ ou -)

L et D **same** name

→ (L - D) or (D - L)

L et D **not same** name

→ (L + D)

Bataille Azimuth (T5)

m = − 0.38

n = − 0.22

m+n = − 0.60

Z = 43° **Zv = 317°**

Z → Zv	*Latitude North*		*Latitude South*	
	m + n > 0	*m + n < 0*	*m + n > 0*	*m + n < 0*
LHA > 180° morning	Zv = Z	Zv = 180 – Z	Zv = 180 – Z	Zv = Z
LHA < 180° afternoon	Zv = 360 – Z	Zv = 180 + Z	Zv = 180 + Z	Zv = 360 – Z

Hs = 27°31',6

ε = -1',5

Dip = - 3',6 +

Ha = 27°26',5

+ *sun correct.* LL/UL = - 14',5 +

Ho = 27°41',0

San Francisco

Date 06 / 01 / 2022

UT 18h 34m 54s

index error = - 3'

\+ *non adjust.error* = + 1',5 +

ε = - 1',5

L = 34°40' N

G = 123°15' W

Height of the eye = 4 m

☒ *lower limb* ☐ *upper limb*

GHA = 088°31'

+ *pp* = 8°43',5 increment)

GHA = 097°14',5 G = West→ subtract

G = 123°15' W G = East→ add

LHA = 333°59',5

LHA < 180° ; sun in the West; $P = LHA$

LHA >180° ; sun in the East; $P = 360 - LHA$

P = 026°00',5 ☒ **NE** ☐ **NW** ☐ **SE** ☐ **SW**

(d ↑ *or* ↓ = 0',3 ↓)

D = 22°25',9 S

corr. d = - 0',2↓

D = 22°25',7 S

L = 34°40' ⇒

D = 22°25',7 +/-

(L/D) = 57°05',7 ⇒

(T1) LOG COS L = 9,9151

(T1) LOG COS D = 9,9659

(T2) LOG VERSINE P = 9,0055 +

LOG 2e T = 28,8865

(T3) COS (L/D) = 0,5433

(T4) NAT 2e T = 0,07700 —

SIN Hc = 0,4663

(T3) Hc = 27°47',5

Ho = 27°41',0

Hc = 27°47',5 —

intercept = -6',5 (+ ou -)

L et D **same** name

→ (L - D) or (D - L)

L et D **not same** name

→ (L + D)

Bataille Azimuth (T5)

m = − 0.51

n = − 0.34

m+n = − 0.85

Z = 27° **Zv = 153°**

Z → Zv	*Latitude North*		*Latitude South*	
	m + n > 0	*m + n < 0*	*m + n > 0*	*m + n < 0*
LHA > 180° morning	Zv = Z	Zv = 180 – Z	Zv = 180 – Z	Zv = Z
LHA < 180° afternoon	Zv = 360 – Z	Zv = 180 + Z	Zv = 180 + Z	Zv = 360 – Z

Hs = 52°18'

ε = 2',8

Dip = - 2',5 +

Ha = 52°18',3

+ *sun correct.* LL/UL = - 15',3 +

Ho = 52°33',6

Galapagos

Date 06 / 06 / 2022

UT 15h 58m 54s

index error = **+ 1'**

\+ *non adjust.error* = + 1',8 +

ε = 2',8

L = 03°58' S

G = 086°54' W

Height of the eye = 2 m

☒ *lower limb* ☐ *upper limb*

GHA = 045°18',9

+ *pp* = 14°43',5 increment)

GHA = 060°02',4 G = West→ subtract

G = 086°54' W G = East→ add

LHA = 333°08',4

LHA < 180° ; sun in the West; $P = LHA$

LHA >180° ; sun in the East; $P = 360 - LHA$

P = 026°51',6 ☐ **NE** ☐ **NW** ☒**SE** ☐ **SW**

(d ↑ *or* ↓ = 0',3 ↑)

D = 22°41',5 N

corr. d = 0',3 ↑

D = 22°41',8 N

L = 03°58' ⇒

D = 22°41',8 +/-

(L/D) = 26°39',8 ⇒

(T1) LOG COS L = 9,9990

(T1) LOG COS D = 9,9650

(T2) LOG VERSINE P = 9,0330 +

LOG 2e T = 28,9970

(T3) COS (L/D) = 0,8937

(T4) NAT 2e T = 0,0993 -

SIN Hc = 0,7944

(T3) Hc = 52°36',0

Ho = 52°33',6

Hc = 52°36,'0 —

intercept = -2',4 (+ ou -)

L et D **same** name

→ (L - D) or (D - L)

L et D **not same** name

→ (L + D)

Bataille Azimuth (T5)

m = − 0.06

n = − 0.42

m+n = − 0.48

Z = 44° **Zv = 44°**

Z → Zv	*Latitude North*		*Latitude South*	
	m + n > 0	*m + n < 0*	*m + n > 0*	*m + n < 0*
LHA > 180° morning	Zv = Z	Zv = 180 – Z	Zv = 180 – Z	Zv = Z
LHA < 180° afternoon	Zv = 360 – Z	Zv = 180 + Z	Zv = 180 + Z	Zv = 360 – Z

Hs = 42°11',5

ε = 3',9

Dip = - 3',6 +

Ha = 42°11',8

- *sun correct.* LL/UL = - 15',1 +

Ho = 42°26',9

Tokyo

Date 06 / 03 / 2022

UT 20h 16m 54s

index error = **+ 2'**

\+ *non adjust.error* = + 1',9 +

ε = 3',9

L = 33°21' N

G = 150°18' W

Height of the eye = 4 m

☒ *lower limb* ☐ *upper limb*

GHA = 117°12',5

+ *pp* = 4°13',5 increment)

GHA = 121°26',0 G = West→ subtract

G = 150°18' W G = East→ add

LHA = 331°08',0

LHA < 180° ; sun in the West; $P = LHA$

LHA >180° ; sun in the East; $P = 360 - LHA$

P = 028°52',0 ☒ **NE** ☐ **NW** ☐ **SE** ☐ **SW**

(d ↑ *or* ↓ = 1' ↓)

D = 05°26',1 S

corr. d = 0',3 ↓

D = 05°25',8 S

L = 33°21' ⇒

D = 05°25',8 +/-

(L/D) = 38°46',8 ⇒

(T1) LOG COS L = 9,9219

(T1) LOG COS D = 9,9980

(T2) LOG VERSINE P = 9,0943 +

LOG 2e T = 29,0142

(T3) COS (L/D) = 0,7796

(T4) NAT 2e T = 0,1033 -

SIN Hc = 0,6763

(T3) Hc = 42°33',5

Ho = 42°26',9

Hc = 42°33' 5 —

intercept = -6',6 (+ ou -)

L et D **same** name

→ (L - D) or (D - L)

L et D **not same** name

→ (L + D)

Bataille Azimuth (T5)

m = − 0.48

n = − 0.08

m+n = − 0.56

Z = 41° **Zv = 139°**

Z → Zv	*Latitude North*		*Latitude South*	
	m + n > 0	*m + n < 0*	*m + n > 0*	*m + n < 0*
LHA > 180° morning	Zv = Z	Zv = 180 – Z	Zv = 180 – Z	Zv = Z
LHA < 180° afternoon	Zv = 360 – Z	Zv = 180 + Z	Zv = 180 + Z	Zv = 360 – Z

Hs = 56°17',5

ε = - 0',4

Dip = - 2',5 -

Ha = 56°14',6

+ sun correct. LL/UL = 15',3 +

Ho = 56°29',9

Pointe -à- Pitre

Date 26 / 09 / 2022

UT 13h 54m 01s

index error = - 2'

\+ *non adjust.error* = +1',6 +

ε = - 0',4

L = 16°34' N

G = 059°25' W

Height of the eye = 2 m

☒ *lower limb* ☐ *upper limb*

GHA = 017°10',2

+ pp = 13°30',3 increment)

GHA = 30°40',5 G = West→ subtract

G = 059°25',0 W G = East→ add

LHA = 331°15',5

LHA < 180° ; sun in the West; $P = LHA$

LHA >180° ; sun in the East; $P = 360 - LHA$

P = 028°44',5 ☒ NE ☐ NW ☐ SE ☐ SW

(d ↑ *or* ↓ = 1' ↑)

D = 01°21',8 S

corr. d = 0',9 ↑

D = 01°22',7 S

L = 16°34' ⇒

D = 01°22',7 +/-

(L/D) = 17°56',7 ⇒

(T1) LOG COS L = 9,9816

(T1) LOG COS D = 9,9999

(T2) LOG VERSINE P = 9,0906 +

LOG 2e T = 29,0721

(T3) COS (L/D) = 0,9514

(T4) NAT 2e T = 0,1180 -

SIN Hc = 0,8334

(T3) Hc = 56°27'

Ho = 56°29'9

Hc = 56°27',0' —

intercept = 2',9 (+ ou -)

L et D **same** name

→ (L - D) or (D - L)

L et D **not same** name

→ (L + D)

Bataille Azimuth (T5)

m = − 0.25

n = − 0.02

m+n = − 0.27

Z = 61° **Zv = 119°**

Z → Zv	*Latitude North*		*Latitude South*	
	m + n > 0	*m + n < 0*	*m + n > 0*	*m + n < 0*
LHA > 180° morning	Zv = Z	Zv = 180 – Z	Zv = 180 – Z	Zv = Z
LHA < 180° afternoon	Zv = 360 – Z	Zv = 180 + Z	Zv = 180 + Z	Zv = 360 – Z

Hs = 46°07',3

ε = 7'

Dip = - 3',6 +

Ha = 46°10',7

+ *sun correct.* LL/UL = 15',1 +

Ho = 46°25',8

Rotterdam

Date 11 / 06 / 2022

UT 08h 54m 01s

index error = + 5'

\+ *non adjust.error* = + 2' +

ε = 7'

L = 52°08' N

G = 003°54' E

Height of the eye = 4 m

☒ *lower limb* ☐ *upper limb*

GHA = 300°05',2

+ *pp* = 13°30',3 increment)

GHA = 313°35',5 G = West→ subtract

G = 003°54',0 E G = East→ add

LHA = 317°29',5

LHA < 180° ; sun in the West; $P = LHA$

LHA >180° ; sun in the East; $P = 360 - LHA$

P = 042°30',5 ☒ NE ☐ NW ☐ SE ☐ SW

(d ↑ *or* ↓ = 0',2 ↑)

D = 23°05',4 N

corr. d = 0',2 ↑

D = 23°05',6 N

L = 52°08' ⇒

D = 23°05',6 +/-

(L/D) = 29°02',4 ⇒

(T1) LOG COS L = 9,7880

(T1) LOG COS D = 9,9637

(T2) LOG VERSINE P = 9,4197 +

LOG 2e T = 29,1714

(T3) COS (L/D) = 0,8743

(T4) NAT 2e T = 0,1484 -

SIN Hc = 0,7259

(T3) Hc = 46°32',5

Ho = 46°25',8

Hc = 46°32',5 —

intercept = - 6',7 (+ ou -)

L et D **same** name

→ (L - D) or (D - L)

L et D **not same** name

→ (L + D)

Bataille Azimuth (T5)

m = − 0.58

n = + 0,26

m+n = − 0.32

Z = 65° **Zv = 115°**

Z → Zv	Latitude North		Latitude South	
	m + n > 0	*m + n < 0*	*m + n > 0*	*m + n < 0*
LHA > 180° morning	Zv = Z	Zv = 180 – Z	Zv = 180 – Z	Zv = Z
LHA < 180° afternoon	Zv = 360 – Z	Zv = 180 + Z	Zv = 180 + Z	Zv = 360 – Z