



# XXI. Heights of Whernside, Great Whernside, Rumbles Moor, Pendle hill, and Boulsworth

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96 Mr. J. Nixon's *Heights of Whernside, Great Whernside,*

expresses himself as follows: "La théorie des équations dérivées, porte naturellement à conclure que toute valeur qui peut satisfaire à une équation dérivée donnée doit être renfermée dans son équation primitive, pourvu que celle-ci ait toute la généralité dont elle est susceptible, par les constantes arbitraires qui doivent y entrer. Il y a néanmoins des équations dérivées auxquelles satisfont des valeurs que j'appelle *singulières*, parce qu'elles ne sont pas comprises dans leurs équations primitives\*." Again: "On doit conclure de là que, pour que  $x$  soit une valeur singulière non comprise dans la valeur générale, il faut," &c.†

I here terminate these observations; nor shall I again trespass on the pages of the Philosophical Magazine, by any further remarks upon a subject which has now been so fully set before its readers.

July 6, 1836.

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XXI. *Heights of Whernside, Great Whernside, Rumbles Moor, Pendle Hill, and Boulsworth.* By JOHN NIXON, Esq.‡

THE following trigonometrical differences of level, measured at numerous stations for the determination of the above altitudes, having been calculated, under a range of distances of from four to thirty miles, with the *constant* refraction of the formula given in my last (vol. viii. p. 480), are submitted as a severe test of its claims to general accuracy. The details of some of the measurements have been already given, and those of the remainder will appear in my surveys of Wharfedale, Ribblesdale, &c.

For every station each day's observation of the difference of level between the standard hill and the other (calculated in the manner described in pages 437-8 of vol. vi.) is arranged in a separate line.

*Trigonometrical Differences of Level.*

<i>Whernside above Ingleborough.</i>								Feet.
				At Ingleborough	..	..	..	41·2
At Great Whernside	..	..	45·0	—————	..	..	..	38·8
Settrensides	..	..	40·5 (a)	—————	..	..	..	40·0
—————	..	..	41·2	Penygent	..	..	..	42·3
Raisegill Hag	..	..	41·8	—————	..	..	..	40·9
Cosh	..	..	40·6	—————	..	..	..	39·8

\* *Calcul des Fonctions*, p. 178.

† *Ibid.*, p. 234.

‡ Communicated by the Author.

§ The mark (a) denotes that as there was no accompanying observation of the standard hill, its *average* difference of level was used in the calculation.

	Feet.
At Whan Fell .. ..	41·3
Dod Fell .. ..	43·3
Whernside .. ..	42·4
Knoutberry Hill .. ..	40·8
Great Whitber .. ..	41·9
.....	41·5
Moughton Fell .. ..	41·7
Shunnor Fell .. ..	39·9
Hunt's Cross .. ..	42·6
Mean .. ..	+41·4
Height of Ingleborough	2384·5*
----- Whernside	2426·0

*Ingleborough above Great Whernside.*

At Great Whernside .. ..	68·9
.....	69·7
.....	61·4
.....	65·6
.....	66·0
.....	65·8
Arncliffe Moor† .. ..	58·3
Settersonside .. ..	61·7 (a)
.....	63·0
.....	64·7
Raisegill Hag .. ..	56·1 ‡
Ryeloaf .. ..	64·2
Rumbles Moor .. ..	64·1 (a)
.....	62·4
.....	57·5
.....	65·3
.....	66·0 (a)
.....	62·6
Symon Seat .. ..	64·2
Pendle Hill .. ..	53·6
Penygant .. ..	61·4
.....	65·4
.....	64·9
Dod Fell .. ..	61·6
Knoutberry Hill .. ..	67·4
Grisedale Edge .. ..	66·1
Ingleborough .. ..	66·0
.....	66·4
.....	65·6
Mean .. ..	—63·7
Height of Ingleborough	2384·5
----- Gt. Whernside	2320·8

*Whernside above Great Whernside.*

At Great Whernside .. ..	106·4
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	Feet.
At Settersonside .. ..	102·2
.....	104·2 (a)
Raisegill Hag ‡ .. ..	97·9
Ingleborough .. ..	106·0 (a)
.....	106·4 (a)
.....	105·6 (a)
Penygant .. ..	103·7
.....	106·3
.....	104·7
Dod Fell .. ..	105·0
Knoutberry Hill .. ..	108·2
Mean .. ..	—105·3
Height of Whernside	2426·0
----- Gt. Whernside	2320·7
Do. by Ingleborough	2320·8
Mean .. ..	2320·8

*Ingleborough above Rumbles Moor.*

At Great Whernside .. ..	1056·7
.....	1052·5 (a)
.....	1049·7
.....	1057·0
Arncliffe Moor† .. ..	1048·3
Settersonside .. ..	1056·0
Rumbles Moor .. ..	1061·0
.....	1049·7
.....	1059·5
.....	1049·0
Symon Seat .. ..	1056·3
Pendle .. ..	1047·9
Ingleborough .. ..	1055·8
.....	—1053·8
Height of Ingleborough	2384·5
----- Rumbles Moor	1330·7

*Great Whernside above Rumbles Moor.*

At Great Whernside .. ..	987·8
.....	986·3
.....	988·3
.....	991·2
Arncliffe Moor .. ..	990·0
Settersonside .. ..	993·8 (a)
.....	989·4
Howber Hill .. ..	991·2
.....	986·3
.....	991·4 (a)
.....	989·6 (a)
.....	988·1
.....	987·6

\* See Lond. and Edinb. Phil. Mag., vol. vi. p. 440.

† At this station Ingleborough has evidently been measured in defect.

‡ The height of Great Whernside has been observed considerably in defect from Raisegill Hag.

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	Feet.		Feet.
Rumbles Moor ..	990·7	Arncliffe Moor .. ..	474·2
_____ ..	998·6	_____ .. ..	483·7
_____ ..	992·2	Settersonside .. ..	488·1 (a)
_____ ..	994·2	Ryeloaf .. ..	476·0
_____ ..	988·8	Howber Hill .. ..	474·0
_____ ..	992·2	_____ .. ..	486·7 (a)
Gt. Almas Cliff ..	1001·7	_____ .. ..	477·0
Symon Seat .. ..	993·2	Rumbles Moor .. ..	481·4 (a)
_____ .. ..	992·4	_____ .. ..	487·3
_____ .. ..	992·1	_____ .. ..	491·7 (a)
Pendle .. ..	994·3	_____ .. ..	492·0
Draughton Moor ..	988·7	_____ .. ..	491·8
_____ .. ..	989·0	_____ .. ..	494·8
_____ .. ..	988·5	Symon Seat .. ..	487·1
Flasby Fell .. ..	986·8	_____ .. ..	480·0
Halton Height .. ..	985·4	Pendle .. ..	486·9
_____ .. ..	985·6	Draughton Moor ..	480·0
Ingleborough ..	989·8	_____ .. ..	486·8
Mean .. ..	990·5	_____ .. ..	485·8
Ht. of Gt. Whernside	2320·8	Flasby Fell .. ..	480·4
— Rumbles Moor	1330·3	Kilnsey Moor .. ..	478·3
Do. by Ingleborough	1330·7	_____ .. ..	476·0
Mean .. ..	1330·5	Halton Height .. ..	480·9
		_____ .. ..	483·6
<i>Ingleborough above Pendle Hill.</i>		Ingleborough .. ..	470·7 (a)
At Great Whernside ..	538·8	_____ .. ..	470·2
_____ ..	549·3	Penygent .. ..	483·9
_____ ..	542·8 (a)	Knoutberry Hill ..	472·9
_____ ..	548·0	Mean .. ..	481·6
Arncliffe Moor .. ..	542·0	Height of Gt. Whernside	2320·8
Settersonside .. ..	551·1	— Pendle Hill ..	1839·2
Ryeloaf .. ..	540·2		
Rumbles Moor .. ..	543·4 (a)	<i>Pendle Hill above Rumbles Moor.</i>	
_____ ..	551·4 (a)	At Great Whernside ..	518·0
_____ ..	554·1	_____ ..	508·8 (a)
_____ ..	554·0 (a)	_____ ..	509·7
_____ ..	549·3	_____ ..	509·0
_____ ..	560·1	Arncliffe Moor .. ..	506·3
Symon Seat .. ..	544·2	Settersonside .. ..	505·7
Pendle Hill .. ..	540·5	Howber Hill .. ..	512·3
Ingleborough .. ..	536·7	_____ .. ..	504·7
_____ .. ..	536·2	_____ .. ..	510·7
Penygent .. ..	545·3	Rumbles Moor .. ..	511·4
Knoutberry Hill ..	540·3	_____ .. ..	503·4
Smearsitt .. ..	544·1	_____ .. ..	506·9
Mean .. ..	545·6	_____ .. ..	500·9
Height of Ingleborough	2384·5	_____ .. ..	500·4
— Pendle Hill	1839·0	_____ .. ..	499·4
		Symon Seat .. ..	505·3
<i>Great Whernside above Pendle Hill.</i>		_____ .. ..	512·1
At Great Whernside ..	469·9	Pendle Hill .. ..	507·4
_____ ..	479·6	Draughton Moor ..	508·8
_____ ..	476·6	_____ .. ..	502·2
_____ ..	482·2	_____ .. ..	502·7
		Lippersley Pike ..	511·0

	Feet.
At Flasby Fell .. ..	506·4
Halton Height .. ..	504·5
————— .. ..	502·0
Ingleborough .. ..	519·3
Mean .. ..	+507·3
Height of Rumbles Moor	1330·5
———— Pendle Hill ..	1837·8
Pendle Hill by Inglebro'	1839·0
———— Gt. Whernside	1839·2
———— Rumbles Moor	1837·8
Mean .. ..	1838·7*

*Ingleborough above Boulsworth.*

At Great Whernside ..	674·7
Arncliffe Moor .. ..	667·0
Rumbles Moor .. ..	685·2 (a)
———— .. ..	682·4
———— .. ..	680·3
Symon Seat .. ..	680·0
Pendle .. ..	665·5
————	—676·5
Height of Ingleborough	2384·5
———— Boulsworth	1708·0

*Great Whernside above Boulsworth.*

At Great Whernside ..	608·9
Arncliffe Moor .. ..	608·6
Howber Hill .. ..	610·4 (a)
———— .. ..	611·5
Rumbles Moor .. ..	621·1
———— .. ..	625·0
———— .. ..	615·0
Symon Seat .. ..	615·7
Pendle .. ..	611·4
Draughton Moor ..	614·2
———— .. ..	614·8
Halton Height .. ..	611·2
———— .. ..	608·3
Mean .. ..	613·6
Height of Gt. Whernside	2320·8
———— Boulsworth	1707·2

*Boulsworth above Rumbles Moor.*

At Great Whernside ..	382·3
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	Feet.
Arncliffe Moor .. ..	381·4
Howber Hill .. ..	379·2
———— .. ..	376·1
Rumbles Moor .. ..	369·6
———— .. ..	367·3
———— .. ..	379·2
The Chevin .. ..	377·0
Symon Seat .. ..	376·4
Pendle .. ..	383·0
Draughton Moor ..	374·5
———— .. ..	374·2
Lippersley Pike ..	380·8
Halton Height .. ..	374·2
———— .. ..	377·3
Mean .. ..	+376·8
Height of Rumbles Moor	1330·5
———— Boulsworth	1707·3

*Pendle above Boulsworth.*

At Great Whernside ..	126·7
Arncliffe Moor .. ..	125·0
Howber Hill .. ..	129·6 (a)
———— .. ..	134·6
Rumbles Moor .. ..	133·8
———— .. ..	133·1
———— .. ..	120·2
Symon Seat .. ..	135·7
Pendle .. ..	124·5
Draughton Moor ..	134·3
———— .. ..	128·0
Lippersley Pike ..	130·2
Halton Height .. ..	130·3
———— .. ..	124·7
Mean .. ..	—129·3
Height of Pendle ..	1838·7
———— Boulsworth	1709·4
Boulsworth by Inglebro'	1708·0
———— Great Whernside	1707·2
———— Rumbles Moor	1707·3
———— Pendle .. ..	1709·4
Mean .. ..	1708·0

It will be seen from the following statement, that Colonel Mudge's measurements of the above altitudes (above mean low water, spring tides,) are invariably less than mine.

\* This height is exclusive of the Beacon hillock (about 7 or 8 feet high).

	Mudge.	Nixon.	Diff.
Ingleborough .....	2361	2384·5	+ 23·5
Great Whernside .....	2263	2320·8	+ 57·8
Whernside (in Ingleton Fells) .....	2384	2426·0	+ 42·0
Pendle Hill .....	1824*	1838·7	+ 14·7
Boulsworth Hill .....	1689	1708·0	+ 19·0
Rumbles Moor.....	1308	1330·5	+ 22·5

Ilkley, May 24, 1836.

JOHN NIXON.

XXII. On a Property of the Parabola. By J. W. LUBBOCK, Esq., F.R.S.†

IN the 8th volume of Gergonne's *Annales de Mathématiques*, p. 9, M. Poncelet has given the following theorem:

“ Un triangle étant circonscrit à une parabole, si on lui circonscrit à son tour une circonférence de cercle, elle passera nécessairement par le foyer même de la courbe.”

See also a paper by M. Steiner in the 19th volume of the same work.

The proofs which have been given of this elegant property of the parabola are indirect, and however ingenious they may be, it seems desirable to show how the theorem in question may be deduced immediately from the equation to the curve. The general methods of analytical geometry may be deemed incomplete and imperfect while they do not embrace questions of this nature, and their great advantage is liable to be overlooked.

Let A B C be a triangle, and let  $x_1, y_1, x_2, y_2, x_3, y_3$ , be the coordinates of the points A, B, C. I propose to prove that if the lines A B, B C, A C touch a parabola the focus of the parabola is in the circumference of the circumscribing circle A B C.

The equation to any straight line passing through given points  $(x_1, y_1), (x_2, y_2)$  is

$$y - y_2 = \frac{y_1 - y_2}{x_1 - x_2} (x - x_2).$$

The equation to the tangent passing through the point  $(x_1, y_1)$  and touching a curve in the point  $(x, y)$  is

$$y - y_1 = \frac{dy}{dx} (x - x_1).$$

This equation is generally given for rectangular coordinates

\* This height is probably *inclusive* of the Beacon hillock.

† Communicated by the Author.