THE TARDIEU SCALE
TRAINING MANUAL

The Tardieu Scale: Principles

Grading always performed:

- On a muscle at rest prior to the stretch maneuver;
- At a reproducible velocity of stretch. Once the fast velocity is selected for a muscle, it remains the same for all subsequent tests;
- At the same time of the day;
- In a constant body position for a given limb;
- Other joints, particularly the neck, must also remain in a constant position throughout the assessment and for all other assessments.

Velocity of Stretch is indicated for each muscle and remains the same from one test to another, as follows:

V_1 = The velocity is as ***slow*** as possible (greater than three seconds)

V_3 = The velocity is as ***fast*** as possible (less than one second)

Angle of Resistance is where increased resistance is first felt:

X_{V1} = The angle of arrest at ***slow*** speed of stretch.
(The angle of the end of range or maximum passive range of motion.)

X_{V3} = The angle where the catch-and-release or clonus is first felt at ***fast*** speed (less than one second)

X: Spasticity Angle:

$X_{V1} – X_{V3} = X$
The Spasticity Angle reflects the velocity-dependence of the stretch reflex.
The larger the spasticity angle the more spastic the muscle.

- By definition, in cases of spasticity grades Y equal to 0 or 1, no spasticity angle is specified and the spasticity angle is then given the value 0 (i.e. $X_{V1} = X_{V3}$) for statistical analysis. The spasticity angle is positive by definition.
- Note: In some cases the Tardieu Scale may also use X_{V2}, which is the velocity of the limb segment naturally falling under gravity. X_{V2} is only practical for knee extensors, wrist extensors, and elbow flexors in severely paretic patients, and will not be evaluated in the current study.

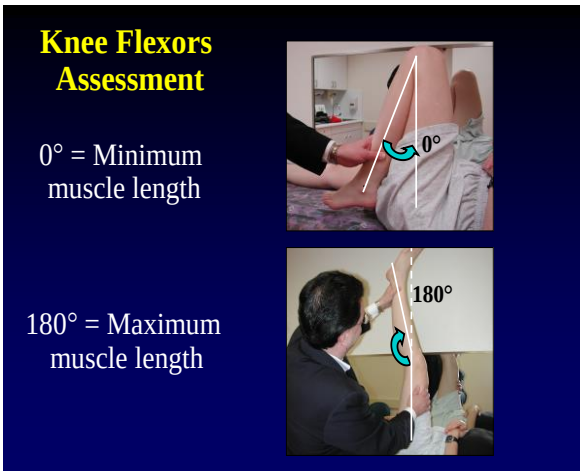
Y: Spasticity Grade or Quality of the Muscle Reaction (GAIN):

Y is an ordinal variable that grades the type and intensity (gain) of the muscle reaction to fast stretch (X_{V3}). The phenomenon associated with each grade can only correspond to muscle contraction induced by stretch reflex, not contracture or inadvertent voluntary contraction, in contrast to other scales that have been assumed to measure spasticity.

- *Grade 0*: No resistance throughout passive movement. A "catch" not followed by release that consistently occurs at the end of the range of passive motion. It represents absent spasticity.
- *Grade 1*: Slight resistance throughout passive movement. Mild resistance slowing down the passive movement without complete interruption. It is likely due to a motor neuron pool discharge that is not sufficiently synchronized to generate an opposing force matching that of the examiner.
- *Grade 2:* Clear catch at precise angle, interrupting passive movement.. Transient interruption of the passive movement (catch and release). This likely reflects a stronger motor neuron discharge that is sufficiently synchronized to generate an opposing force temporarily matching that of the examiner (catch). The motor neuron discharge then decreases allowing the passive movement to resume (release).
    - In cases where the catch is not followed by obvious release, but occurs repeatedly at a *consistent* angle less than the passive range of motion, it is still accepted as angle of catch-and-release and the grade Y is still considered 2.
- *Grades 3 and 4*:
    - When the release occurs at a speed that is itself faster than the velocity threshold of the stretch reflex, it triggers a new stretch reflex and thus a clinical sensation of re-catch. Following the re-catch comes a re-release, which in succession is termed clonus.
    - *Grade 3*: Fatigable clonus (less than 10 seconds when maintaining pressure) occurring at a precise angle.
    - *Grade 4:* Unfatigable clonus (more than 10 seconds when maintaining pressure) occurring at a precise angle.
- *Non-ratable* describes a catch not followed by obvious release that occurs at inconsistent angles upon repeat testing. This may correspond to inadvertent voluntary contractions or to non-spastic dystonia. The spasticity is deemed non-ratable (no value for Grade Y).

- Catch **without release**: graded 0 if $X_{V1} = X_{V3}$;
- Catch **without release**: graded 2 if X_{V3} is consistent and consistently < $X_{V1;}$
- Catch with **"minimal" release**: graded 2 if X_{V3} is consistent and consistently < $X_{V1;}$
- Catch with **"minimal" release**: graded 'unratable' if X_{V3} is variable / inconsistent;
- For grades 0 and 1, Spasticity Angle = 0 by definition

Note: The degrees of measurement used with the Tardieu Scale may differ from the degrees of measurement traditionally used in clinical practice. The minimum muscle length is always 0° and the maximum muscle length is always 180°. See examples below. See conversion tables in the appendix for examples for the ankle and knee.



Tardieu Knee Flexors Assessment:

A. Position of the Patient
   1. Supine.
   2. Opposite leg is straight with hip extended at 180 degrees.
   3. Arms are in a comfortable position for the patient.
   4. Head is midline and resting on the examination table.

B. Position of the Examiner's Hands During Testing
   1. One hand maintains hip stabilization at 90 degrees of hip flexion by grasping the femoral medial and lateral condyles anteriorly at the top of the knee.
   2. As much as possible, avoid any hip adduction, abduction, or rotation.
   3. One hand holds the distal 1/3rd of the limb proximal to the ankle posteriorly.

C. Procedure and Measurement of X_{V1} and X_{V3}

X_{V1}

1. X_{V1} measures the angle of arrest at slow speed of stretch (the angle of the end of the range or maximum passive range of motion). Move the limb as slow as possible (greater than 3 seconds) to achieve maximum stretch, determined by a hardened feel or expression of discomfort by the patient (movements should be slow, strong and sustained).
2. Measure the popliteal angle.
3. Repeat the measurement 3 times. Choose and record the most reliable / consistent measurement.

X_{V3}

1. Distract the patient with three to ten repetitive, quick movements of the tested limb in the opposite direction of the motion to be evaluated (movements should be fast on flexion and slow on extension).
2. Perform a fast knee extension. X_{V3} = "As fast as possible" (less than one second) for the examiner.
3. Measure the angle where the catch-and-release or clonus, if elicited, is first felt.
4. Repeat the measurement 3 times, repeating the distraction technique prior to each measurement. Choose and record the most reliable/consistent measurement.

D. Grading of the Stretch Reflex

Y is an ordinal variable that grades the type and intensity (gain) of the muscle reaction to fast stretch (X_{V3}).

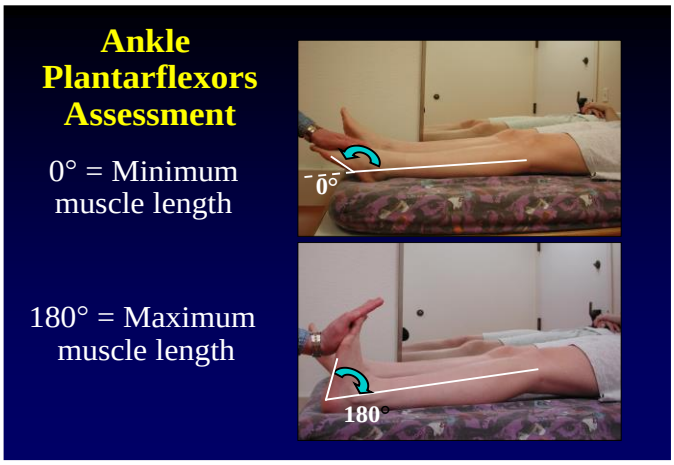
Y: Spasticity Grade: Quality of the muscle reaction (GAIN)

0= No resistance throughout passive movement
1= Slight resistance throughout passive movement
2= Clear catch at precise angle, interrupting passive movement
3= Fatigable clonus (*less* than 10 seconds when maintaining pressure) occurring at a precise angle
4=Unfatigable clonus (*more* than 10 seconds when maintaining pressure) occurring at a precise angle

- Catch **without release**: graded 0 if $X_{V1} = X_{V3}$;
- Catch **without release**: graded 2 if X_{V3} is consistent and consistently $< X_{V1;}$
- Catch with **"minimal" release**: graded 2 if X_{V3} is consistent and consistently $< X_{V1;}$
- Catch with **"minimal" release**: graded 'unratable' if X_{V3} is variable / inconsistent;
- For grades 0 and 1, Spasticity Angle = 0 by definition

E. Measurement of the Spasticity Angle X ($X_{V1} - X_{V3}$)

The Spasticity Angle (X) is X_{V1} minus X_{V3}, which reflects the velocity-dependence of the stretch reflex. By definition, in cases of spasticity grades Y equal to 0 or 1, no spasticity angle is specified and the spasticity angle is then given the value 0 (i.e. $X_{V1} = X_{V3}$) for statistical analysis.



Tardieu Ankle Plantarflexors Assessment:

A. Position of the Patient
   1. Supine.
   2. Opposite leg is straight.
   3. For the side to be assessed, the hip is flexed at 135 degrees, with the knee flexed at 135 degrees.
   4. Arms are in a comfortable position for the patient.
   5. Head is midline and resting on the examination table.

B. Position of the Examiner's Hands During Testing
   1. To stabilize the lower limb, one hand holds the leg in the middle 1/3 of the limb posteriorly.
   2. Hold the foot in a neutral position, neither varus nor valgus. Subtalar neutral.
   3. Grasp at forefoot from the plantar aspect.

C. Procedure and Measurement of X_{V1} and X_{V3}

X_{V1}

1. X_{V1} measures the angle of arrest at slow speed of stretch (the angle of the end of the range or maximum passive range of motion). Move the limb as <u>slow as possible</u> (greater than 3 seconds) to achieve maximum stretch, determined by a hardened feel or expression of discomfort by the patient (movements should be slow, strong and sustained).
2. Measure the angle.
3. Repeat the measurement 3 times. Choose and record the most reliable / consistent measurement.

X_{V3}

1. Place the patient in the resting position and plantarflex the foot.
2. Distract the patient with three to ten repetitive, quick movements of the tested limb in the opposite direction of the motion to be evaluated (movements should be fast on flexion and slow on extension).
3. Perform a fast foot dorsiflexion. X_{V3} = "As fast as possible" (less than one second) for the examiner.
4. Measure the angle where the catch-and-release or clonus, if elicited, is first felt.
5. Repeat the measurement 3 times, repeating the distraction technique prior to each measurement. Choose and record the most reliable / consistent measurement.

D. Grading of the Stretch Reflex

Y is an ordinal variable that grades the type and intensity (gain) of the muscle reaction to fast stretch (X_{V3}).

Y: Spasticity Grade: Quality of the muscle reaction (GAIN)

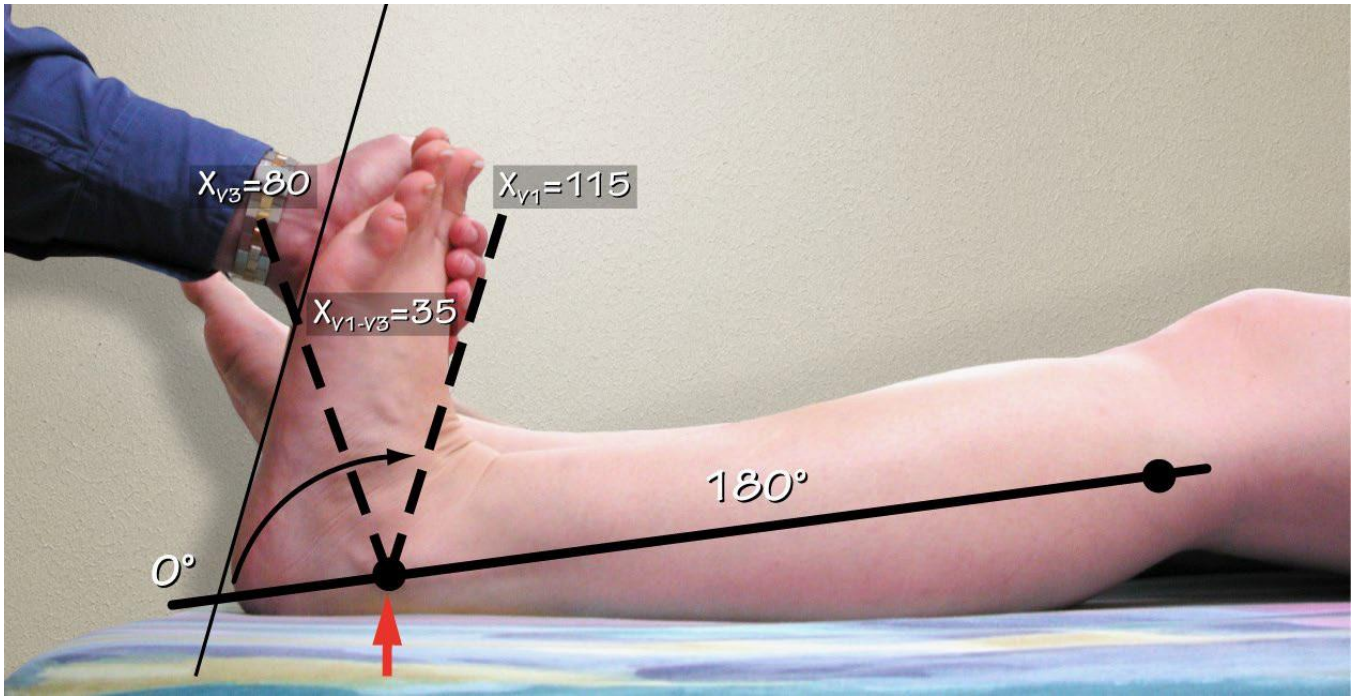
0= No resistance throughout passive movement
1= Slight resistance throughout passive movement
2= Clear catch at precise angle, interrupting passive movement
3= Fatigable clonus (*less* than 10 seconds when maintaining pressure) occurring at a precise angle
4=Unfatigable clonus (*more* than 10 seconds when maintaining pressure) occurring at a precise angle

- Catch **without release**: graded 0 if $X_{V1} = X_{V3}$;
- Catch **without release**: graded 2 if X_{V3} is consistent and consistently $< X_{V1;}$
- Catch with **"minimal" release**: graded 2 if X_{V3} is consistent and consistently $< X_{V1;}$
- Catch with **"minimal" release**: graded 'unratable' if X_{V3} is variable / inconsistent;
- For grades 0 and 1, Spasticity Angle = 0 by definition

E. Measurement of the Spasticity Angle X ($X_{V1} - X_{V3}$)

The Spasticity Angle (X) is X_{V1} minus X_{V3}, which reflects the velocity-dependence of the stretch reflex. By definition, in cases of spasticity grades Y equal to 0 or 1, no spasticity angle is specified and the spasticity angle is then given the value 0 (i.e. $X_{V1} = X_{V3}$) for statistical analysis.

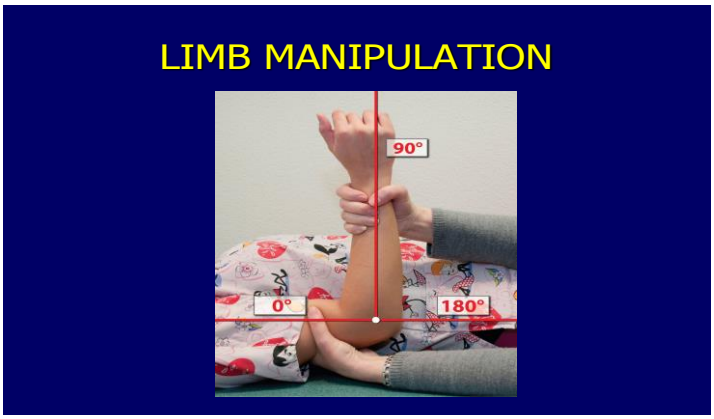
The difference $X_{V1} - X_{V3}$ is the Spasticity Angle (X), which reflects the velocity-dependence of the stretch reflex.



Tardieu Elbow Flexors Assessment:

A. Position of the Patient:
   1. Patient is supine.
   2. Opposite arm is in a comfortable position for the patient.
   3. Head is midline & resting on the examination table.

B. Position of the Examiner's Hands During Testing:
   1. Stabilize the proximal limb by holding the arm posteriorly on the distal 1/3 of humerus.
   2. Keep shoulder stable by maintaining the arm close to the chest and parallel to the mid-axillary line.
   3. Hold the distal limb at the distal 1/3 of the forearm posteriorly keeping the arm in a position as close to neutral as possible.



C. Procedure and Measurement of X_{V1} and X_{V3}

X_{V1}

1. X_{V1} measures the angle of arrest at slow speed of stretch (the angle of the end of the range or maximum passive range of motion). Move the limb as <u>slow as possible</u> (greater than 3 seconds) to achieve maximum stretch, determined by a hardened feel or expression of discomfort by the patient (movements should be slow, strong and sustained).
2. Measure the angle.
3. Repeat the measurement 3 times. Choose and record the most reliable / consistent measurement.

X_{V3}

1. Distract the patient with three to ten repetitive, quick movements of the tested limb in the opposite direction of the motion to be evaluated (movements should be fast on flexion and slow on extension).
2. Perform a fast elbow extension. X_{V3} = "<u>As fast as possible</u>" (less than one second) for the examiner.
3. Measure the angle where the catch-and-release or clonus, if elicited, is first felt.
4. Repeat the measurement 3 times, repeating the distraction technique prior to each measurement. Choose and record the most reliable/consistent measurement.

D. Grading of the Stretch Reflex

Y is an ordinal variable that grades the type and intensity (gain) of the muscle reaction to fast stretch (X_{V3}).

Y: Spasticity Grade: Quality of the muscle reaction (GAIN)

0= No resistance throughout passive movement

1= Slight resistance throughout passive movement

2= Clear catch at precise angle, interrupting passive movement

3= Fatigable clonus (*less* than 10 seconds when maintaining pressure) occurring at a precise angle

4=Unfatigable clonus (*more* than 10 seconds when maintaining pressure) occurring at a precise angle

- Catch **without release**: graded 0 if $X_{V1} = X_{V3}$;
- Catch **without release**: graded 2 if X_{V3} is consistent and consistently $< X_{V1;}$
- Catch with **"minimal" release**: graded 2 if X_{V3} is consistent and consistently $< X_{V1;}$
- Catch with **"minimal" release**: graded 'unratable' if X_{V3} is variable / inconsistent;
- For grades 0 and 1, Spasticity Angle = 0 by definition

E. Measurement of the Spasticity Angle X ($X_{V1} – X_{V3}$)

The Spasticity Angle (X) is X_{V1} minus X_{V3}, which reflects the velocity-dependence of the stretch reflex. By definition, in cases of spasticity grades Y equal to 0 or 1, no spasticity angle is specified and the spasticity angle is then given the value 0 (i.e. $X_{V1} = X_{V3}$) for statistical analysis.

Wrist Flexor Assessment:

A. Position of the Patient
1. Supine.
2. Opposite arm is in a comfortable position for the patient.
3. Head is midline and resting on the examination table

B. Position of the Examiner's Hands During Testing
1. Hold the forearm posteriorly on the distal 1/3 just proximal to the wrist joint, keeping the forearm pronated.
2. The examiner's thumb is placed on the midpoint of the dorsal surface on the patient's 3rd metacarpal. The examiner's fingers are placed on the patient's mid-palm, allowing the patient's fingers to be free during the evaluation.

C. Procedure and Measurement of X_{V1} and X_{V3}

X_{V1}
1. X_{V1} measures the angle of arrest at slow speed of stretch (the angle of the end of the range or maximum passive range of motion). Move the limb as <u>slow as possible</u> (greater than 3 seconds) to achieve maximum stretch, determined by a hardened feel or expression of discomfort by the patient (movements should be slow, strong and sustained).
2. Measure the angle.
3. Repeat the measurement 3 times. Choose and record the most reliable / consistent measurement.

X_{V3}
1. Distract the patient with three to ten repetitive, quick movements of the tested limb in the opposite direction of the motion to be evaluated (movements should be fast on flexion and slow on extension).
2. Perform a fast wrist extension. X_{V3} = "<u>As fast as possible</u>" (less than one second) for the examiner.
3. Measure the angle where the catch-and-release or clonus, if elicited, is first felt.
4. Repeat the measurement 3 times, repeating the distraction technique prior to each measurement. Choose and record the most reliable/consistent measurement.

D. Grading of the Stretch Reflex

Y is an ordinal variable that grades the type and intensity (gain) of the muscle reaction to fast stretch (X_{V3}).

Y: Spasticity Grade: Quality of the muscle reaction (GAIN)

0= No resistance throughout passive movement
1= Slight resistance throughout passive movement
2= Clear catch at precise angle, interrupting passive movement
3= Fatigable clonus (*less* than 10 seconds when maintaining pressure) occurring at a precise angle
4=Unfatigable clonus (*more* than 10 seconds when maintaining pressure) occurring at a precise angle

- Catch **without release**: graded 0 if $X_{V1} = X_{V3}$;
- Catch **without release**: graded 2 if X_{V3} is consistent and consistently $< X_{V1;}$
- Catch with **"minimal" release**: graded 2 if X_{V3} is consistent and consistently $< X_{V1;}$
- Catch with **"minimal" release**: graded 'unratable' if X_{V3} is variable / inconsistent;
- For grades 0 and 1, Spasticity Angle = 0 by definition

E. Measurement of the Spasticity Angle X ($X_{V1} – X_{V3}$)

The Spasticity Angle (X) is X_{V1} minus X_{V3}, which reflects the velocity-dependence of the stretch reflex. By definition, in cases of spasticity grades Y equal to 0 or 1, no spasticity angle is specified and the spasticity angle is then given the value 0 (i.e. $X_{V1} = X_{V3}$) for statistical analysis.

Patient must remain in a constant position throughout the test. Head should be in midline or in a constant position each time tested.

Velocity of Stretch:

V_1 = The velocity is as ***slow*** as possible (greater than three seconds)

V_3 = The velocity is as ***fast*** as possible (less than one second)

Angle of Resistance:
X_{V1} = The angle of arrest at ***slow*** speed of stretch. (The angle of the end of range or maximum passive range of motion.)
X_{V3} = The angle of where the catch-and-release or clonus is first felt at ***fast*** speed (less than one second)

X: SPASTICITY ANGLE:
$X_{V1} – X_{V3} = X$
The Spasticity Angle reflects the velocity-dependence of the stretch reflex. The larger the spasticity angle the more spastic the muscle.

Y: SPASTICITY GRADE: **Quality of the muscle reaction (GAIN):**

- **0** = No resistance throughout passive movement
- **1** = Slight resistance throughout passive movement
- **2** = Clear catch at precise angle interrupting passive movement,
- **3** = Fatigable clonus (*less* than 10 seconds when maintaining pressure) occurring at a precise angle
- **4** = Unfatigable clonus (*more* than 10 seconds when maintaining pressure) occurring at a precise angle

- *Catch without release: graded 0 if $X_{V1} = X_{V3}$;*
- *Catch without release or "minimal" release: graded 2 if X_{V3} is consistent and consistently < X_{V1};*
- *Catch with "minimal" release: graded 'unratable' if X_{V3} is variable / inconsistent;*
- *For grades 0 and 1, the Spasticity Angle = 0 by definition.*

TARDIEU
SPASTICITY SCALE

Date:_____

Patient:_____

Investigator:_____

X = Degree Y = 0 - 4

Position: Supine

Visual Estimate

Indicate X/Y for Left & Right
***Indicate 'NR' if not ratable**

		LEFT	RIGHT
Muscle group:	**X_{V1}**		
	X_{V3}		
	X (V1-V3)		
	Y		
Muscle group:	**X_{V1}**		
	X_{V3}		
	X (V1-V3)		
	Y		

Ankle Range of Motion Conversion Chart [Clinic Angle + 90 Degrees = Tardieu Angle]	
Standard Clinic Angles	**Tardieu Angle Conversion**
-90º	0º
-75º	15º
-60º	30º
-45º	45º
-35º	55º
-30º	60º
-25º	65º
-20º	70º
-15º	75º
-10º	80º
-5º	85º
0º Neutral	90º
5º	95º
10º	100º
15º	105º
20º	110º
25º	115º
30º	120º
35º	125º
45º	135º
60º	150º
75º	165º
90º	180º

Example: 20º Clinical = 110º Tadieu

Example: -45º Clinical = 45º Tardieu

Knee Range of Motion Conversion Chart [180 Degrees minus Clinic Angle = Tardieu Angle]	
Standard Clinic Angles	**Tardieu Angle Conversion**
0	180
10	170
20	160
30	150
40	140
50	130
60	120
80	100
90	90
100	80
110	70
120	60
130	50
140	40
150	30
160	20
170	10
180	0