

2025 5th Annual Stroke Symposium

"Don't Lose SIGHT of Our Goal...FUNCTION"

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May 16, 2025



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Objectives:

- 1 Explain how the location of a stroke affects visual-perceptual functioning and discuss basic statistics regarding the incidence of visual-perceptual impairment post-stroke.
- 2 Identify at least 1 appropriate assessment tool to screen or assess for oculomotor impairment, visual field deficit, and spatial neglect.
- 3 Identify at least 1 appropriate intervention strategy to target a patient's specific visual and perceptual needs to increase function in daily tasks.
- 4 Identify at least 3 patient behaviors indicative of visual-perceptual impairment post-stroke and explain how to incorporate multi-disciplinary treatment techniques to optimize patient outcomes.

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Vision: Why is it important?

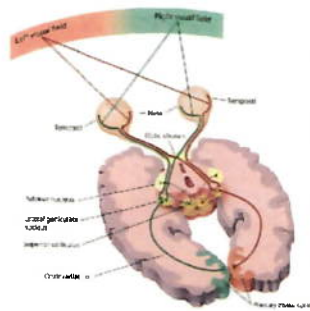
- The eyes bring in visual information, but the brain sees, not the eyes!
- 1/3 to 1/2 of the brain is devoted to visual processing
- We are all primary visual learners
- Consequences of Visual-Perceptual Impairment



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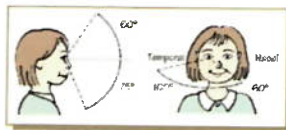
Review of the Visual Pathway



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Normal Visual Scanning

- **Visual Field**
 - 180 degrees horizontally
 - 135 degrees vertically
 - Visual field of each eye overlaps centrally
- **Normal visual scanning**
 - Allow us to gather information from all fields of our vision
 - Allows for quick scanning and identification of our surroundings



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Review of the Extraocular Muscles



- **Muscle function:**
 - Superior Rectus- upward movement
 - Inferior Rectus- downward movement
 - Lateral Rectus- outward movement
 - Medial Rectus- inward movement
 - Superior Oblique- downward and outward movement
 - Inferior Oblique- upward and outward movement

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Review of Oculomotor System

- Brain stem (CN3, CN 4, CN 6)
- Cerebellum
- Cortex

Cranial Nerve	Muscles	Resulting Deficit
Oculomotor Nerve (CN 3)	• Medial rectus • Superior rectus • Inferior rectus • Inferior oblique • Levator palpebrae superioris	• Exotropia (outward position of eye) • Difficulty/unable to make vertical or medial eye movements • Horizontal diplopia viewing near objects • Eyelid ptosis
Trochlear Nerve (CN 4)	• Superior oblique	• Does not cause significant eye deviation • Vertical diplopia
Abducens Nerve (CN 6)	• Lateral rectus	• Esotropia (inward position of the eye) • Horizontal diplopia viewing distant objects

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What if there is a problem?



VISUAL FIELD DEFICIT



SPATIAL NEGLECT



OCULOMOTOR IMPAIRMENT

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Visual Deficits Post-Stroke

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Visual Field Deficits Post-Stroke

Visual field defects

Types of lesions

- Hemianopia**- loss of vision in **half** of the visual field in one or **both** eyes
- Homonymous Hemianopia**- loss of half of the visual field on the **same side** in both eyes
- Heteronymous Hemianopia**- loss of half of the visual field on **different sides** in both eyes (aka- **Bilateral hemianopia**)
- Location**- nasal, temporal, inferior, superior

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Hemianopsia Statistics

Most common visual deficit post-stroke

Occurs in up to 30% of all strokes

Occurs in 70% of all strokes in the PCA

Also common in the MCA

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Functional Deficits of HH

Peripheral field loss

- Bumping into objects
- Slow hesitant walking
- Startled when person approaches from affected side
- Following a leader, getting lost or taking extra time to navigate spaces

Central field loss

- Difficulty with reading and writing
- Uncommon
- Challenges more likely when central vision loss occurs on same side as dominant hand/foot

IADLs/Insight

- Frequent tripping
- Inability to drive
- Inability to read medications, manage finances

Patient awareness

- False sense of usable vision due to perceptual completion
- Neglect can co-occur
- Anterior lesions = reduce awareness

Recovery

- Partial recovery 20-30% of patients in first 3 months
- Peripheral field recovery most common

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Screening for Visual Field Deficit

- **OTs cannot diagnose hemianopsia, but we can assess how vision impacts performance!**
- **Chart Review**
- **Self Assessment**
 - **Brain Injury Vision Symptoms Survey (BIVSS)**



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Programs are approved

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Screening for Visual Field Deficits

- **Confrontation Test (1 person, 2 people)**
 - Gross screen, can use goniometer for closer measurement
 - Sustained fixation and attention to a central target
 - Second target coming into visual field and patient recognizing
 - Behavior - slower response to targets
- **Scanning and Reading Tests**
 - Letter Cancellation Tests
 - Brain Injury Visual Assessment Battery for Adults (BIVA)
 - **Behaviors** - right to left scanning pattern, abbreviated search in the affected side, organized approach to scanning but errors made, long time check work



A V T E I O L P R W Q G S F L G D I Z E R P C I N M E F
 I T Q Q I A R I F L A R N V L G I D I P L G L G S F
 Q T V E G I G R F S T E I V L I P L G I D I P L G I
 S W R E G L Y I Y L V L M T P G I N T T Q I N G
 V G T E I S T E N I L G I T E W A Z I G T O C T F I
 M E T O P K I N M T Y I S L G I T E W A Z I G T O C T F I
 T E I L I N G I D I W I M T I S I P A Z S I G I N
 R E I O U K A I K I S F L I T I A R P L I N L A R N

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Frequency: 1000 Hz

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Screening For Visual Deficits- Light Boards

Dytavision

**Vision Coach**

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Documenting Suspected Visual Field Deficit

How to document a potential left homonymous hemianopia without calling it homonymous hemianopia.

Sam demonstrates difficulty with reading, fatiguing quickly and showing increased rate of errors when text is located on the left side of the page. Sam also demonstrates significant delay when performing random scanning activities on Vision Coach interactive lightboard, with an overall increased reaction time to stimuli to the left of midline. Furthermore, Sam was noted to trail the wheel on the right when performing functional mobility tasks in the hallway and was noted to bump into objects on the left side when not seated. These deficits impact his ability to locate grooming items on stock, scan environment for potential obstacles, thus increasing fall risk. Finally, he is at risk for making mistakes with medication management due to reading challenges.

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Creating Intervention Plan For Visual Field Deficit

Self Awareness Training

- Must show patients that they can no longer trust their vision
- Using hands to explore into area of vision loss
- Disappearing stimuli
- Adding stimuli to the affected visual field during another activity

Effective Search Training

- Head Turns
- Making mental map before entering room
- Begin in static environments and work towards dynamic environments

Reading Training

- Line Guide
- Typoscope
- Repositioning paper (shifting to one side or vertically)
- Visual anchor
- Repetitive left to right scanning saccades worksheets
- Task Lighting
- High Contrast
- Find optimal reading text size

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Spatial Neglect Post-Stroke

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Spatial Neglect Statistics

- Most common with right hemisphere strokes (incidence rate of up to 70% initially post-stroke)
- Commonly associated with lesions of the inferior parietal lobe or temporoparietal region, superior temporal cortex, or frontal lobes
- Associated with lower performance on ADL & IADL measures
- Independent predictor of functional outcome from inpatient rehabilitation
- Longer length of inpatient rehab stay (LOS 11 days longer)

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Spatial Neglect Subtypes



PERSONAL
NEGLECT



PERIPERSONAL
NEGLECT



EXTRAPERSONAL
NEGLECT

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Personal Neglect

Definition/Deficits:

- Neglect of hemiplegic body parts of one's own body
- Misjudges body's midline
- Fails to groom or dress left side of the body
- Denial of body part in severe cases

Assessment:

- Comb and Razor Test
- Fluff Test

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Fluff Test



Figure 8.7 illustrates the Fluff Test, a method for assessing body awareness. The diagram shows a human figure with dots placed on various body parts. The photographs show a person wearing a blue jumpsuit with white dots, used to identify and label body parts.

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Peripersonal Neglect

Definition/Deficits:

- Neglect of space within arms reach (tabletop)
- Difficulty finding food on the table
- Difficulty with reading/paper tasks
- Difficulty locating items on the countertop

Assessment:

- Baking Tray Test
- Line Bisection Test
- Cancellation Tests
 - Stars Cancellation
 - Bell's Cancellation

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A. Normal line bisection B. Highly impaired line bisection

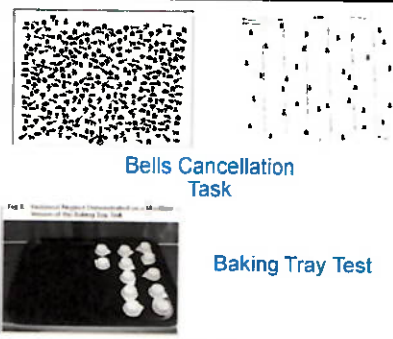
Line Bisection Test



Star Cancellation Task

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Bells Cancellation Task

Baking Tray Test

Fig. 2. Assessment of Neglect: Cancellation Task. A 10x10 grid of dots with some dots crossed out. Fig. 3. Assessment of Neglect: Baking Tray Test. A tray with 10 small objects, some of which are crossed out.

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Extrapersonal Neglect

Definition/Deficits:

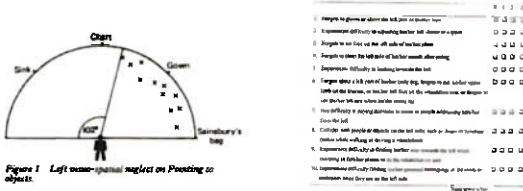
- Neglect within large space environments
- Entire bathroom/kitchen
- Hallway
- Street, shopping area
- Impaired is mobility based
- Frequently bumping into objects/walls

Assessment:

- Point to Objects Test
- Catherine Bergego Scale

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Point to Objects Test

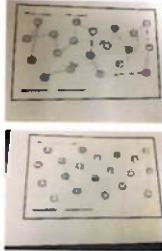
Catherine Bergego Scale

Figure 1. Left hemispatial neglect on Pointing to objects. The diagram shows a semi-circle with a person at the center. The left side is labeled 'Sink' and the right side is labeled 'Cupboard'. The person is pointing to the left side. The scale is a list of 10 items with checkboxes for 'Yes', 'No', and 'Don't know'.

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Assessing the Patient's Scanning Strategy



Subset of Brain Injury Visual Assessment Battery for Adults
<https://www.vrabilities.com/bivaba.html>

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Documenting Spatial Neglect

During grooming tasks, Sara requires cuing to locate soap and wash cloth positioned on the L side of the sink. When asked to wash her upper body, Sara failed to wash her L arm and L leg without cuing. Sara positions head with cervical rotation to the R, needing moderate verbal cues and min tactile cue to achieve midline orientation. During narrated scan course, Sara missed the hallway on the left side x 2 despite cues. These deficits are suggestive of **left unilateral spatial neglect** in the personal, peripersonal and extrapersonal space. These deficits impact safety during basic ADLs and mobility tasks.

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Differences between Hemianopsia and Spatial Neglect

Hemianopsia	Spatial Neglect
Organized search pattern Able to sustain attention to task until its completion	Unorganized search pattern Unable to focus for periods of times; may complete task quickly due to attention difficulties
Performance improves with cues	Performance does not improve with cues
Shows awareness of mistakes when cued	Unaware of mistakes despite cuing

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Spatial Neglect Interventions

- **Visual Scanning Training**
 - Initiate search from left side
 - Execute a symmetrical and organized search pattern
 - Execute complete search to the left
 - Anticipate visual input occurring on the left
 - Shifting search between left and right fields
 - Observe all visual detail
- **Limb Activation**
 - Movement of the affected side may function as a motor stimulus activating the right hemisphere, thus improving neglect
- **TENS**
 - Applied to the left posterior neck muscles reduce neglect by causing the patient to detect and identify stimuli in the left field
 - Frequency 100 Hz, Pulse Duration 100 us, Intensity sensory threshold (pleasant tingling), applied via 2 x 2 electrodes on posterolateral aspect of the neck (lateral to spine) and upper traps on neglected side x 10 minutes

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Oculomotor Impairment Post-Stroke

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Oculomotor Nerve (CN 3)

Oculomotor palsy



Innervates the eye muscle that allow for visual tracking and gaze fixation

Impairment- Exotropia Horizontal diplopia with near vision tasks

↓

Also innervates upper eyelid

Impairment- ptosis

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Abducens Nerve (CN 6)

RIGHT 6th NERVE PALSY



Innervates the lateral rectus muscle

Impairment- Esotropia Horizontal diplopia with distance vision

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Trochlear Nerve (CN 4)

RIGHT 4th NERVE PALSY



Innervates the superior oblique muscle

Impairment- Hypertropia Vertical diplopia

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"Cheater Muscle"

Subtle and harder to observe
Clients compensate by using abnormal head position

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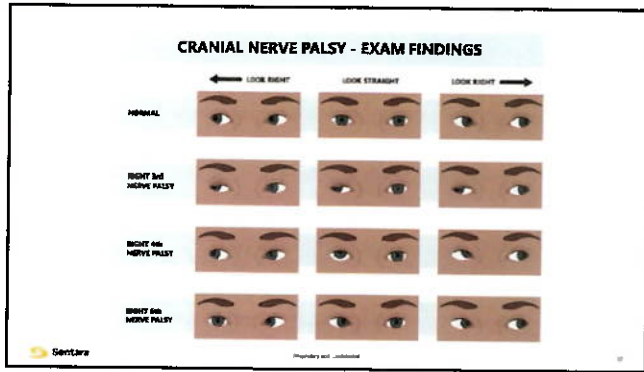
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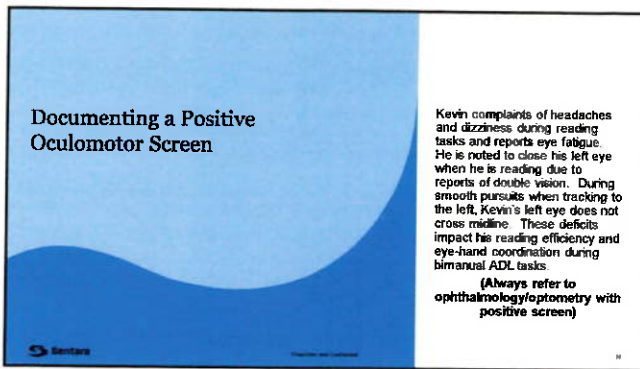
Screening for Oculomotor Impairment

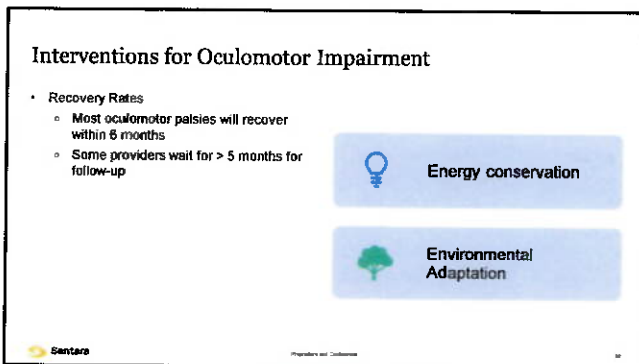
- OTs can **SCREEN** but cannot **DIAGNOSE** oculomotor impairment!
- Self Report Tests
 - Brain Injury Vision Symptom Survey (BIVSS)
- Ocular Observations
 - Pupillary symmetry
 - Eyelid symmetry
- Smooth Pursuits

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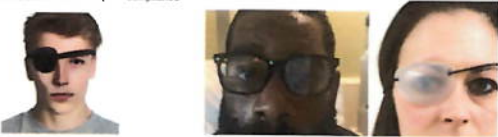






Partial Occlusion Taping

- Diplopia should symptomatically resolve when one eye is occluded
- Full occlusion patching
 - Promotes monocular vision
 - Limits peripheral vision
 - Decreases spatial orientation
 - Requires a rotation schedule- poor compliance
- Partial Occlusion Patching
 - Allow for binocular vision
 - Increased light for retinal activation
 - Tape does not need to be switched from left to right lens
 - Increased compliance



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Partial Occlusion Taping

- Determine Eye Dominance**
- Tape Non-Dominant Eye**
- Apply just enough tape to block the area of asymmetrical visual input**

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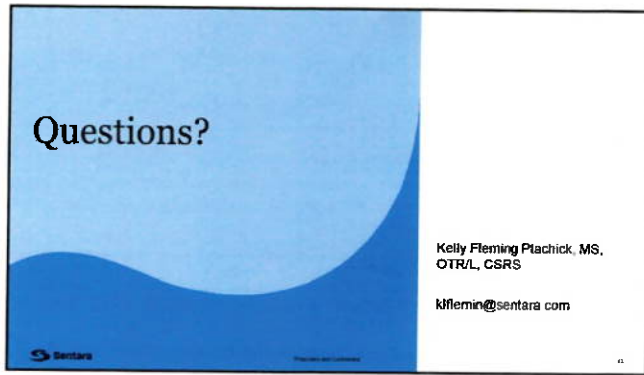
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Interdisciplinary Treatment of Visual-Perceptual Deficits

- Screen/Assess our patients for visual and visual perceptual impairments and how they impact function
- Address these deficits within the context of our scope of practice
- Educate family members and other medical staff on how to best set-up the patient's environment and how to best approach the patient to encourage visual-perceptual training
- Refer patient's ophthalmology and optometry for formalized testing

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BIVSS CHECKLIST (Brain Injury Vision Symptom Survey)

Patient Name: _____ Today's date: _____

My brain injury was: _____ years ago My age is: _____ years today's date: _____

☐ I have had a medical diagnosis of brain injury (check box if true) Cause of injury: _____☐ I sustained a brain injury without medical diagnosis (check box if true) _____☐ I have NOT ever sustained a brain injury (check box if true) _____

Please check the most appropriate box, or circle the item number that best matches your observations. All information will be held in confidence. Thank you for your help!

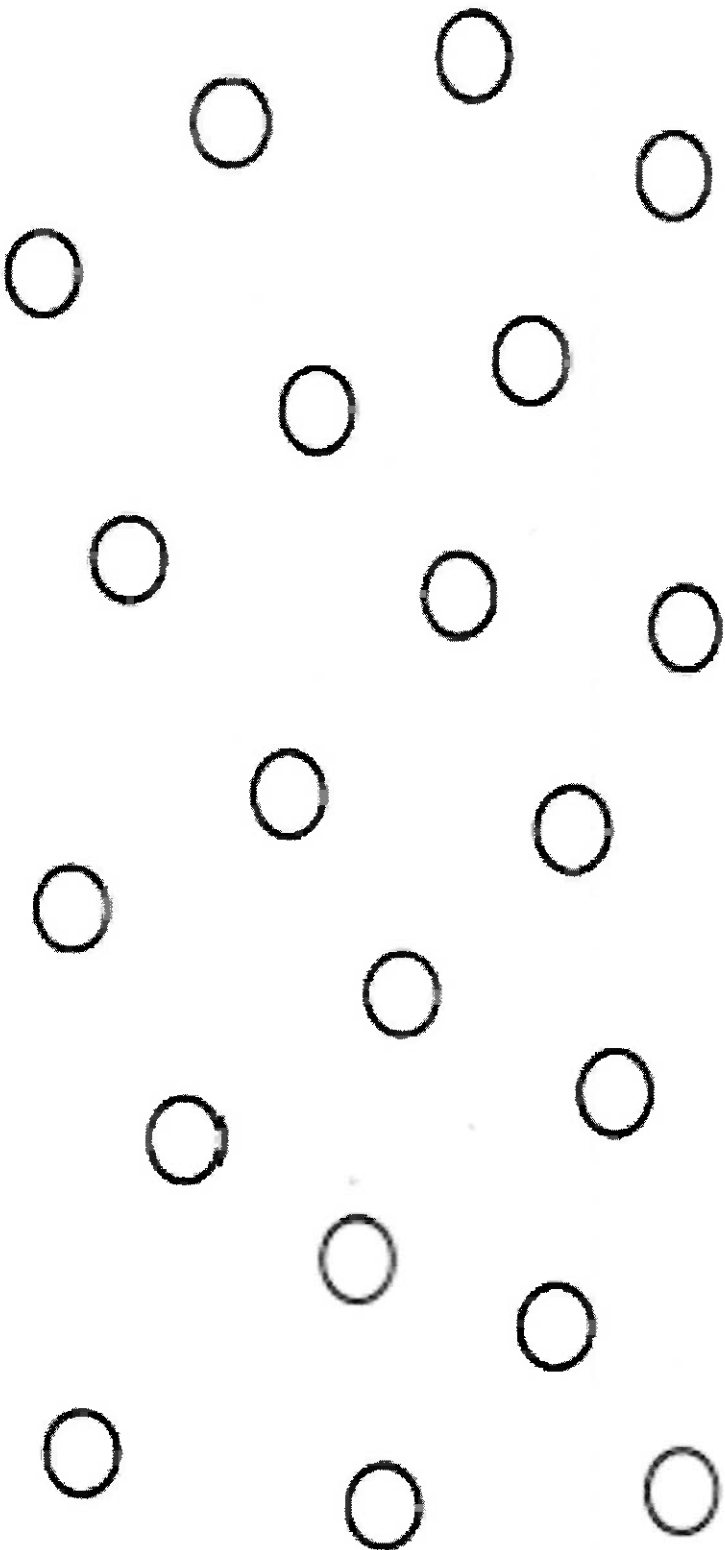
SYMPTOM CHECKLIST

Circle a number below:

Please rate each behavior. How often does each behavior occur? (circle a number)	Never	Seldom	Occasionally	Frequently	Always
EYESIGHT CLARITY					
Distance vision blurred and not clear -- even with lenses	0	1	2	3	4
Near vision blurred and not clear -- even with lenses	0	1	2	3	4
Clarity of vision changes or fluctuates during the day	0	1	2	3	4
Poor night vision / can't see well to drive at night	0	1	2	3	4
VISUAL COMFORT					
Eye discomfort / sore eyes / eyestrain	0	1	2	3	4
Headaches or dizziness after using eyes	0	1	2	3	4
Eye fatigue / very tired after using eyes all day	0	1	2	3	4
Feel "pulling" around the eyes	0	1	2	3	4
DOUBLING					
Double vision -- especially when tired	0	1	2	3	4
Have to close or cover one eye to see clearly	0	1	2	3	4
Print moves in and out of focus when reading	0	1	2	3	4
LIGHT SENSITIVITY					
Normal indoor lighting is uncomfortable -- too much glare	0	1	2	3	4
Outdoor light too bright -- have to use sunglasses	0	1	2	3	4
Indoors fluorescent lighting is bothersome or annoying	0	1	2	3	4
DRY EYES					
Eyes feel "dry" and sting	0	1	2	3	4
"Stare" into space without blinking	0	1	2	3	4
Have to rub the eyes a lot	0	1	2	3	4
DEPTH PERCEPTION					
Clumsiness / misjudge where objects really are	0	1	2	3	4
Lack of confidence walking / missing steps / stumbling	0	1	2	3	4
Poor handwriting (spacing, size, legibility)	0	1	2	3	4
PERIPHERAL VISION					
Side vision distorted / objects move or change position	0	1	2	3	4
What looks straight ahead--isn't always straight ahead	0	1	2	3	4
Avoid crowds / can't tolerate "visually-busy" places	0	1	2	3	4
READING					
Short attention span / easily distracted when reading	0	1	2	3	4
Difficulty / slowness with reading and writing	0	1	2	3	4
Poor reading comprehension / can't remember what was read	0	1	2	3	4
Confusion of words / skip words during reading	0	1	2	3	4
Lose place / have to use finger not to lose place when reading	0	1	2	3	4

NAME _____

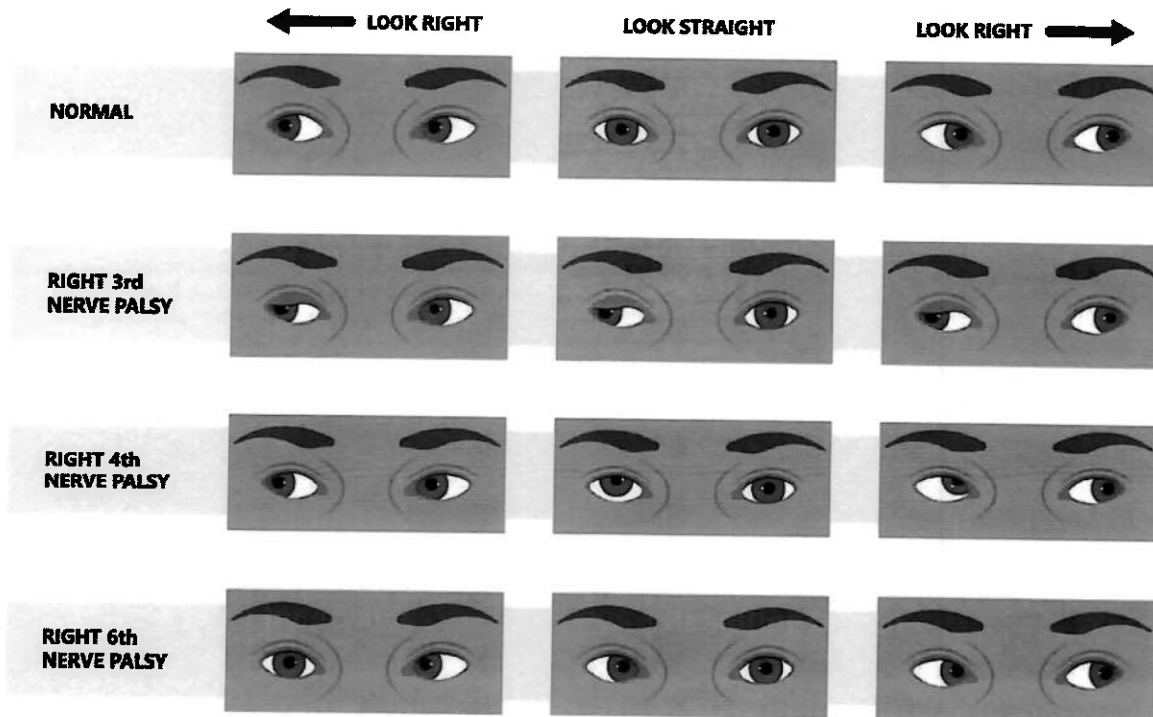
DATE _____



NAME _____

DATE _____

CRANIAL NERVE PALSY - EXAM FINDINGS



Cranial Nerve	Innervates	Resulting Deficit
Oculomotor Nerve (CN 3)	- Medial rectus - Superior rectus - Inferior rectus - Inferior oblique - Levator palpebrae superioris	- Exotropia (outward position of eye) - Difficulty/unable to make vertical or medial eye movements - Horizontal diplopia viewing near objects - Eyelid ptosis
Trochlear Nerve (CN 4)	Superior oblique	- Does not cause significant eye deviation - Vertical diplopia
Abducens Nerve (CN 6)	Lateral rectus	- Esotropia (inward position of the eye) - Horizontal diplopia viewing distant objects

A
V
R
Q
W
N
C
S
M
J
H
Z
D
A
B
Z
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X
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G
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K
X
B
P
Y
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O
M
P
D
H
P

Read the underlined letters out loud

2M

<u>A</u>	B	U	J	T	O	P	<u>K</u>	Y	T	R	M	H
U	<u>K</u>	V	F	J	H	<u>C</u>	X	<u>X</u>	W	L	M	G
I	O	L	<u>K</u>	J	G	D	W	A	<u>Q</u>	C	V	<u>M</u>
H	<u>H</u>	N	I	M	J	<u>C</u>	B	V	D	<u>X</u>	Z	T
<u>K</u>	G	H	U	J	<u>O</u>	L	<u>P</u>	<u>Q</u>	E	D	Z	A
G	X	W	A	<u>D</u>	C	T	<u>V</u>	G	B	H	N	J
N	U	N	<u>M</u>	H	G	Y	B	N	V	<u>O</u>	R	I
C	K	<u>M</u>	O	M	<u>N</u>	H	Y	<u>K</u>	F	T	R	V
S	Y	<u>B</u>	<u>N</u>	I	O	P	L	M	<u>N</u>	H	E	S
A	Z	<u>W</u>	X	C	V	B	N	M	<u>B</u>	J	U	Y
N	<u>S</u>	R	D	V	B	C	<u>N</u>	M	<u>K</u>	L	P	O
<u>D</u>	<u>U</u>	<u>Y</u>	T	E	D	C	V	C	W	D	F	<u>G</u>
S	H	N	M	B	<u>V</u>	R	T	H	<u>G</u>	F	H	<u>J</u>
<u>P</u>	K	L	<u>O</u>	I	U	Y	T	R	V	D	R	<u>W</u>
E	<u>D</u>	<u>S</u>	X	V	B	Y	J	N	<u>S</u>	O	P	L
R	G	<u>N</u>	B	C	X	<u>Z</u>	M	N	H	<u>Y</u>	G	F
V	E	H	<u>Q</u>	K	<u>J</u>	U	I	Y	T	<u>O</u>	N	H
<u>N</u>	M	B	<u>G</u>	T	E	<u>W</u>	Q	A	Z	X	<u>C</u>	V
Y	<u>U</u>	J	K	F	<u>O</u>	L	T	P	D	<u>S</u>	A	C
Q	W	E	<u>R</u>	T	Y	<u>U</u>	I	<u>O</u>	P	H	J	<u>G</u>
A	S	<u>D</u>	F	R	K	<u>V</u>	X	Z	V	D	<u>S</u>	O

Cross out the designated letter everytime it appears in the line

- a bcdheaghfaeslgagachtarubaqofsavhgutabgutaqghai
- b cdhbhuierboputybuiondblikiubyuinetughybgbpdmobd
- c ghtdcopoacehjuehjcdcjashuciopacfeuricvbgaqcoas
- d ghjendeuiwdilldjkjdjlkwerbduiodqwgghtuygdpbiokdkn
- e ceauchjebnhydecoiceeaso pevbgeghceoaiuecpiao
- f yuijptfjklipfurtyfxvnbfttujuklpiterijweeurtifjlifpkcnvfjkmjnf
- g htygjkmpjechgjygeopghgeicbopygiuitgbpjqqgqutvmi
- h qwbhjkbkpvbsxefguhrthjkihqwsbhjhjlbng hunhnrifdhol
- i qwiojlibhingbfhiopwjje cntuijklilawjightjivhgltnikjgbvi
- j turijklmngifhrgjjtityruvbiwerjoilgyiijlikmgjightejkl nkbjmn
- k qwekigfznvbt klopilklikhtgyrgkiiheutugyrkgubhnfkqwk p
- l uimenlkiopjlf rlttryewlmngopl kjtlnvhlmbklglitltujtinlijxzk l
- m uinbhmunmionuhgnfmiuwinzxcmlitibnvmczsmnnvcxm
- n qwuinopnumbhhunhsdeiopunomtnoopiunhngjr nuzmi
- o oaeiquaqopghfnqopuo aqohjpgiqoyiropoitfghtoauqao
- p ghfjtupkbn gjlgnpiobeidhpqwustpupopthfutqnjqpbspi
- q poqaenvqpojkiphgquighteqbnghqpiquwrhfhgtpqfjswq
- r utghrunvbriourk jxc riowndkruiuroprrnmbngjvrguthrik r
- s rutswiosopbvmx suighrsyrtusfghrysopgscvbfseyolss
- t turhytjktlltiultituitllitleydhwutlllquitlmbnhjiltiotk jtkxckuti

u aopuyjcvyytufhevyvoluisxzvunqwunbmvnouasdnuiyv
v rytuevuyvyvioeubhtuynbhvqzubyvviopuyvhgyrutivuwi
w utrheovvwughvuthgnmsowwvuiviobnvhgyvwvuionwf
x tughyxcbvghxerytuxcbvfgryxuiopvhgxwxcbgxocxazvl
y uityveubyrheughvnbhguvyvyrt dgyputyghryyuilopizlyvi
z tuyhguzcbvhgzeurhfyzdopbngjzxjchdztyhrufzghzwerns

Find the following words in the letters below

you need like job cat pop eye knife yes go heart
we do ear dog can two rabbit snake not bee an pie
ill take quiet after top call table at none rain sun

ghfjtuthgyfhtghyoubngbvfhbrgdcdbdgeccjobnhtyfhgurhfhedh
likeghtnbhvfbrfpopgthfjfbgkhtfvneedtoghtufhrdheceyeghklj
htfnrhdhkjiuhotufhgknifeghtjfhthyghcatghfrkdjguthfnvhftoank
ghtufjrfekdfjtyesgnvfhjroweifhrgobnghveidlpghuyheartgjhbi
nfjvnfhgwegfgyuhiotgbnghvnriopfhgdcoghfjeoskearfghfnthd
cbmneirufhgtowgjbnnhhfjvnfhdoghjbfnfhvhdrwprotfcanbjtiopie
twoghtjfbthvnrabbitghfnvjfsnakegthyfhrnvhdjvnghyguihju
vnfjvndfdjcnotghfnbhfreyfgrtdbeefhggtyfbvrbdgcbdkslngklja
ldjfldkjfdillakjfklaajdfafterfkldjfkldjquietlkdjfkldjftopadlfjlate
aoaudfoitakeerereartoprjekraecallwoeurowieunonedjflrain
sunaldjfgjkdatalealkjfdkldjfkahgourowurowiutoutrtgorg

head boy girl clock hat in book saw quack the new
may fox red zoo done oar peanut love bad cow at
out make read rock will art hand box cup fellow

fghtyfhrgfheadghtufhgjthvgjhnbfhgnboygjfhgfkfldkfgirlgjhjg
htufjrhfvhbndcjbvnvgjvnclockhghtufhryfhrhatbngghvnfhvufhv
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iohghvbfhquackghfrhtufhegdbvbnbhtdhfgcbwughvnghfv
bdnewghtfthmayghtgfbnfhtidlcogtghfutfhdgrfoxghtjfhredfhgn
vjhfzooghtfhrdoneghvnfheruoarghvnfhvloveghvnfhcbghtuh
vnghfbvhfpeanutghvnfhvbfhbbadbngghvbfchdwptjatbmvnghi
vnghbbfcbfbcowdfjghvfhcmvnghfuriedhvrighfnvchdtlgkhju
akhdfjkashoutlkdjfkldjfmakelfajdfkljasdartfjaldkfjreadfjlajdfy
rocklfajdfkljasdfboxlfjadklfjadsklcupalfellowlakjdfklasjdfwill
qoewiurioqweurhandoeuowqeurwouboxoqieurioquewrio

Cross out the number 88 everytime you see it 2M

445678892344568811223008768688799454
433668867544423881234900866558245567
882348812897745884536779883468856342
389788345881267231224568875688453267
856458834528834588219945238856765889
863458823452779987895688345288653423
788690348845234567884532889342884572
338845336533426678838858866234338856
430088764567897688457823388543883245
165774526788522239605884512378648856
347556778978853236578894563322458898
656887699348232245887634876459886345
623488121238568856348923788543367865
488124587658843562879945886456788906
745884321677896654886528788456328812
883409123587688456883425877345254257
123678834788798899345338823458812389
623488121238568856348923788543367865
488124587658843562879945886456788906
745884321677896654886528788456328812
856458834528834588219945238856765889

Cross out all of the double numbers 2M

8 1 2 6 7 2 3 1 2 2 4 5 6 8 8 7 5 6 8 8 4 5 3 2 6 7 8 5 6 5 8 8 3 4 5 2
8 8 3 4 5 8 8 2 1 9 9 4 5 2 3 8 8 5 6 7 6 5 8 9 8 6 3 4 5 8 8 2 3 4 5 2
7 7 9 9 8 7 8 9 5 6 8 8 3 4 5 8 8 6 5 3 4 2 3 7 8 8 6 9 0 3 4 8 8 4 5 2
3 4 5 6 7 8 8 4 3 2 8 8 9 3 4 2 8 8 4 5 7 2 3 5 5 7 8 9 0 0 3 8 3 9 2 3
3 4 8 5 7 3 6 6 7 4 3 2 5 5 3 4 7 8 9 9 2 3 4 2 2 4 5 6 4 3 1 1 2 3 4 5
6 6 5 4 4 4 5 6 7 7 8 8 9 0 0 6 5 6 7 7 4 5 3 4 5 6 6 5 4 4 4 3 3 2 2 5
6 4 7 2 3 4 5 5 9 8 7 6 7 8 8 8 3 4 5 6 5 5 4 6 6 5 4 6 5 6 7 8 4 2 4 5
2 2 4 4 9 9 8 8 7 6 6 4 6 3 7 8 8 5 3 3 3 6 7 7 5 5 4 4 1 1 6 6 9 5 5 3
3 7 5 5 3 3 2 5 7 3 1 1 1 4 4 6 6 8 4 3 5 5 6 6 7 7 3 6 8 5 7 1 1 4 5 6
8 1 2 6 7 2 3 1 2 2 4 5 6 8 8 7 5 6 8 8 4 5 3 2 6 7 8 5 6 5 8 8 3 4 5 2
8 8 3 4 5 8 8 2 1 9 9 4 5 2 3 8 8 5 6 7 6 5 8 9 8 6 3 4 5 8 8 2 3 4 5 2
7 7 9 9 8 7 8 9 5 6 8 8 3 4 5 8 8 6 5 3 4 2 3 7 8 8 6 9 0 3 4 8 8 4 5 2
3 4 5 6 7 8 8 4 3 2 8 8 9 3 4 2 8 8 4 5 7 2 3 5 5 7 8 9 0 0 3 8 3 9 2 3
3 4 8 5 7 3 6 6 7 4 3 2 5 5 3 4 7 8 9 9 2 3 4 2 2 4 5 6 4 3 1 1 2 3 4 5
8 1 2 6 7 2 3 1 2 2 4 5 6 8 8 7 5 6 8 8 4 5 3 2 6 7 8 5 6 5 8 8 3 4 5 2
8 8 3 4 5 8 8 2 1 9 9 4 5 2 3 8 8 5 6 7 6 5 8 9 8 6 3 4 5 8 8 2 3 4 5 2
7 7 9 9 8 7 8 9 5 6 8 8 3 4 5 8 8 6 5 3 4 2 3 7 8 8 6 9 0 3 4 8 8 4 5 2
3 4 5 6 7 8 8 4 3 2 8 8 9 3 4 2 8 8 4 5 7 2 3 5 5 7 8 9 0 0 3 8 3 9 2 3
3 4 8 5 7 3 6 6 7 4 3 2 5 5 3 4 7 8 9 9 2 3 4 2 2 4 5 6 4 3 1 1 2 3 4 5
8 8 3 4 5 8 8 2 1 9 9 4 5 2 3 8 8 5 6 7 6 5 8 9 8 6 3 4 5 8 8 2 3 4 5 2
7 7 9 9 8 7 8 9 5 6 8 8 3 4 5 8 8 6 5 3 4 2 3 7 8 8 6 9 0 3 4 8 8 4 5 2

Copy the numbers on the left side of the page
onto the blanks on the right side of the page ^{2M}

356 - 7876

288 - 9876

515 - 6687

338 - 9769

486 - 6384

884 - 2633

533 - 8768

495 - 5843

623 - 7391

798 - 6643

896 - 8839

567 - 2121

636 - 7743

788 - 5690

Cross out the number in each row which repeats itself 4 times

2M

1 2 3 4 5 6 5 7 8 9 4 6 3 4 9 8 7 5 6 3 2 8 5 1 3 5 2

1 3 4 7 8 9 8 3 8 9 6 5 6 5 8 9 0 1 8 4 6 7 8 1 6 7 3

5 7 1 6 7 5 4 9 8 8 3 2 1 2 3 7 6 3 7 8 4 5 1 2 7 9 6

0 9 6 7 5 7 4 1 2 3 4 5 6 7 4 7 8 3 3 2 1 2 4 6 5 8 7

3 3 5 6 8 5 4 6 2 3 1 1 9 8 9 1 3 8 5 5 4 5 3 1 3 4 7

7 4 8 1 2 6 7 8 8 9 5 0 8 9 4 5 2 3 9 8 7 8 6 5 6 7 8

5 3 0 1 2 1 6 7 8 5 4 5 8 9 2 1 0 9 8 4 3 2 3 7 8 9 4

8 5 6 7 8 7 9 9 4 3 5 6 2 3 1 2 3 3 9 7 8 9 0 1 2 3 5

6 7 5 6 8 3 4 5 2 6 3 9 1 0 1 2 3 9 7 5 4 0 6 7 8 0 8

2 3 5 6 5 1 3 4 7 8 8 9 5 6 2 1 2 3 3 9 5 6 7 5 7 3 2

7 6 3 4 4 2 1 4 5 1 2 3 3 6 7 8 3 8 9 1 0 3 3 3 2 4 5

4 5 8 9 2 1 4 7 3 5 8 8 0 1 8 9 3 8 4 2 1 0 0 3 4 9 7

0 3 2 1 4 7 7 2 4 8 0 3 3 2 7 5 4 9 7 5 3 7 0 3 1 0 9

answers: 3, 6, 5, 4, 1, 7, 8, 9, 6, 2, 4, 4, 0

Cross out the numbers 1-20 in order

2 5 6 7 1 3 4 5 2 4 3 5 6 7 12 13 4 5 12 10 7 5 3
 6 1 13 5 7 9 4 15 9 17 8 5 4 20 6 7 10 9 15 4 5 10 2
 3 4 6 7 6 11 2 3 6 8 9 12 3 4 5 6 7 3 13 2 3 4 5 6 2
 14 5 6 5 2 18 16 3 4 15 2 6 7 16 6 8 9 2 3 4 5 2 17
 18 5 7 2 3 2 5 8 9 8 2 3 20 19 2 4 5 7 8 2 9 3 2 20

Cross out the numbers 20-35 in order

23 34 56 12 20 23 33 22 56 21 45 34 19 67 34 56 67
 22 56 45 35 45 20 21 23 76 45 24 34 57 89 23 56 34
 24 22 25 32 21 26 34 24 18 15 23 26 27 56 34 27 45
 35 34 28 13 26 27 29 56 34 23 67 27 89 67 30 31 30
 29 56 31 45 55 33 45 32 48 33 23 34 32 31 35 90 34

Cross out the numbers 30-45 in order

33 45 32 30 23 56 78 34 34 31 56 34 38 29 30 32 33
 56 30 32 43 31 67 78 45 32 34 56 34 23 35 56 78 30
 36 33 32 89 56 37 56 78 39 38 45 42 41 45 67 39 41
 45 35 40 34 44 41 56 77 23 38 39 89 30 42 77 43 56
 43 44 34 23 13 56 44 88 43 39 40 41 34 45 44 45 23

Cross out the numbers 60-75 in order

67 89 45 60 90 33 34 56 90 89 31 45 23 51 56 61 82
 90 92 88 82 62 83 83 84 65 63 89 33 45 67 57 34 64
 85 95 35 65 78 56 45 33 88 66 88 77 56 36 67 34 37
 66 34 68 56 34 78 66 90 99 69 33 39 68 71 40 10 70
 71 69 68 70 72 34 67 73 89 71 89 74 99 70 75 72 73