## GENERAL SPEED LAW

**NO PERSON SHALL DRIVE AT A GREATER SPEED THAN IS REASONABLE AND PRUDENT UNDER THE CONDITIONS AND HAVING REGARD FOR THE ACTUAL AND POTENTIAL HAZARDS THEN EXISTING.**

**SPEED MUST BE SO CONTROLLED TO AVOID COLLIDING WITH PERSON OR VEHICLE.**

- **MAXIMUM SPEED LIMITS:**
  - 70 MPH – INTERSTATES WHERE POSTED
  - 60 MPH – MULTILANE DIVIDED, PRIMARY HIGHWAYS WHERE POSTED
  - 55 MPH – IN OTHER LOCATIONS
  - 40 MPH – ON UNPAVED ROADS
  - 55 MPH – MAXIMUM FOR MANUFACTURED HOMES (TEN BELOW MAX POSTED SPEED)
  - 30 MPH – IN URBAN DISTRICTS

- **A DRIVER MUST REDUCE SPEED WHEN:**
  - APPROACHING AND CROSSING INTERSECTION
  - GOING AROUND A CURVE
  - APPROACHING A HILLCREST
  - TRAVELING ON A NARROW ROAD OR BRIDGE
  - OR BY REASON OF WEATHER OR HIGHWAY CONDITIONS

# South Carolina Speeding Law, excerpt

**SECTION 56-5-1520.** General rules as to maximum speed limits; lower speeds may be required.

(A) A person shall not drive a vehicle on a highway at a speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards then existing. Speed must be so controlled to avoid colliding with a person, vehicle, or other conveyance on or entering the highway in compliance with legal requirements and the duty of a person to use care.

(B) Except when a special hazard exists that requires lower speed for compliance with subsection (A), the limits specified in this section or established as hereinafter authorized are maximum lawful speeds, and a person shall not drive a vehicle on a highway at a speed in excess of these maximum limits:

(1) seventy miles an hour on the interstate highway system and other freeways where official signs giving notice of this speed are posted;

(2) sixty miles an hour on multilane divided primary highways where official signs giving notice of this speed limit are posted;

(3) fifty-five miles an hour in other locations or on other sections of highways and unpaved roads are limited to the speed of forty miles an hour; and

(4) manufactured, modular, or mobile homes must not be transported at a speed in excess of ten miles below the maximum posted speed limit when the maximum posted speed limit is in excess of forty-five miles an hour, and never in excess of fifty-five miles an hour.

(C) Thirty miles an hour is the maximum speed in an urban district. "Urban district" means the territory contiguous to and including any street which is built up with structures devoted to business, industry, or dwelling houses situated at intervals of less than one hundred feet for a distance of a quarter of a mile or more.

(D) A local authority on the basis of an engineering and traffic investigation may determine that the maximum speed limit permitted under this article is less than thirty miles an hour in an urban district. If this determination is made, the maximum speed limit for the urban district is enforceable by all law enforcement officers authorized to enforce the traffic laws in the urban district. However, this subsection does not apply to highways within the state highway system contained in Section 56-5-1530.

(F) The driver of a vehicle shall drive, consistent with the requirements of subsection (A), at an appropriate reduced speed when approaching and crossing an intersection or railway grade crossing, when approaching and going around a curve, approaching a hillcrest, when traveling upon any narrow bridge, narrow or winding roadway, and when special hazard exists with respect to pedestrians or other traffic or by reason of weather or highway conditions

*Accessed 07-11-2019 from https://www.scstatehouse.gov/code/title56.ph*

# SPEED LAWS

| ELEMENTS | BASIC SPEED LAW | ABSOLUTE SPEED LAW | PRIMA FACIE SPEED LAW |
|---|---|---|---|
| Driver | Accused must be shown to have been the driver at the time of the infraction. | (Same) | (Same) |
| Location | Any place to which the public has right of access for vehicle use. | (Same) | (Same) |
| Speed | Unreasonable or imprudent | In excess of specified limit and thus are in violation of the law. | In excess of specified limit and thus presumed to be driving unlawfully. |
| Conditions | Having regard to actual and potential hazards. | Not applicable | Having regard to actual and potential hazards. |

South Carolina Criminal Justice Academy

# Radar Log

Officer: _____
Radar Make: _____
Serial Number: _____
F Antennae SN#: _____
R Antennae SN#: _____
Tuning Fork SN#: _____
Tuning Fork SN#: _____

| DATE | TIME | SUMMONS | Internal Circuitry | Internal Light Test | Tuning Fork Tests | | Drive Thru Test | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Front | Rear | Known Speed | Indicated Speed |
| | | | | | F= | R= | Ks= | IS= |
| | | | | | F= | R= | Ks= | IS= |
| | | | | | F= | R= | Ks= | IS=

South Carolina Criminal Justice Academy

# Lidar Log

Officer: _____

Lidar Make: _____

Serial Number: _____

| DATE | TIME | SUMMONS | Internal Circuitry | Internal Light Test | Known Distance Test _____FT | Drive Thru Test | |
|---|---|---|---|---|---|---|---|
| | | | | | | Known Speed | Indicated Speed |
| | | | | | | Ks= | IS= |
| | | | | | | Ks= | IS= |
| | | | | | | Ks= | IS=

# RADAR FORMULAS

## BEAM WIDTH

$$BW = 2D\left(TAN\frac{1}{2}\angle\right) \text{ or more simply}$$

| | | |
|---|---|---|
| 9° RADAR ∠ | = | .16 X Distance in feet |
| 12° RADAR ∠ | = | .21 X Distance in feet |
| 16° RADAR ∠ | = | .28 X Distance in feet |
| 18° RADAR ∠ | = | .31 X Distance in feet |

## COSINE (Stationary Mode)

| | | |
|---|---|---|
| Indicated Speed | = | True Target Speed X Cosine ∠ |
| True Target Speed | = | Indicated Speed ÷ Cosine ∠ |

## COSINE (Moving Mode, with Nichols effect and Shadow effect.)

| | | |
|---|---|---|
| Adjusted Target Speed | = | True Target Speed X Cosine ∠ |
| Closing Rate Speed | = | Patrol Speed + Adjusted Target Speed |

*Adjust Patrol Speed if necessary for Low Doppler Cosine or Shadow effect or both.

## Low Doppler Cosine Effect

| | | |
|---|---|---|
| Adjusted Patrol Speed | = | True Patrol Speed X Cosine ∠ |

## Shadow Effect

| | | |
|---|---|---|
| Adjusted Patrol Speed | = | True Patrol Speed (or adjusted Patrol Speed if Low Doppler Cosine present) – shadow vehicle speed |
| Indicated True Target Speed | = | Closing Rate Speed – Adjusted Patrol Speed |

| | | |
|---|---|---|
| COSINE | = | Negligible until 10 degrees is exceeded |
| STATIONARY COSINE | = | Always in favor of the violator |
| MOVING COSINE | | A cosine error on the patrol speed will result in a high target speed reading. YOU MUST VERIFY PATROL SPEED WITH SPEEDOMETER. |

MOVING RADAR

Target Speed = Closing Speed – Patrol Speed

Target Speed = Separation Speed – Patrol Speed

TIME DISTANCE EQUATIONS

Reaction Time Distance = Speed X (Perception + Reaction) Time X 1.5 X 1.47

Speed = (Reaction Time) Distance ÷ 1.47 ÷ (Perception + Reaction) Time

(Perception + Reaction) Time = (Reaction Time) Distance ÷ 1.47 ÷ Speed

Velocity = Speed X 1.47

TOTAL STOPPING DISTANCE

$S^2 \div 30$ X Drag Factor + Reaction Time Distance

$(S^2 \div 22.5) + (S \text{ X } 1.47 \text{ X } 1.5)$

Drag Factor: Use .75

Reaction Time Distance: Speed X 1.47 X 1.5

RADAR: RAdio Detection And Ranging

TRACKING HISTORY

| | |
|---|---|
| Visual | ID Target<br>Est. Speed<br>Est. Range<br>Check Environment |
| Audio | Pitch<br>Clarity |
| Speed Verification | Constant Readout<br>Consistent with Visual Estimate Verify<br>Patrol Speed with Speedometer |

Scanning: Pointing antenna at counting unit Panning:
Swinging stationary unit toward target Simulation Test:
(Moving)

| | |
|---|---|
| Patrol | 35 |
| Target | 30 |

# FREQUENCY FORMULA

Frequency x Wave Length = The Speed of Light

The speed of light as measured by National Institute of Standards and Technology, (NIST), is 186,282.396 miles per second.

There are 63,360 inches in a mile.

Most wavelengths can more easily be visualized in fractions of an inch than in fractions of a mile. Therefore, you must convert miles per second to inches per second. This is done by multiplying by 63,360 or dividing by 63,360 depending on which conversion you are attempting to make.

**Examples:**

K-band:

$$frequency * \frac{wavelength}{\#\ of\ inches\ in\ a\ mile} = speed\ of\ light$$

$$\mathbf{24,150,000,000 * \frac{.488729918\ in}{63,360\ in} = 186,281.999\ miles\ per\ sec}$$

$$\frac{speed\ of\ light * 63{,}360}{frequency} = wavelength$$

$$\frac{186{,}282 * 63{,}360}{24{,}150{,}000{,}000} = .488729918\ in$$

# STOPPING DISTANCE WORKSHEET

**Stopping Distance**

S = Speed
DF = Drag Factor

$\frac{S^2}{30 \times DF}$ = Distance to Stop Once Brakes are Applied

**Perception/Reaction Distance**

S = Speed
1.47 = Converts mph - feet per second
1.5 = Average perception/reaction

S X 1.47 X 1.5 = Distance Covered During Perception/Reaction Time

Violator's Speed _____

1. Reaction Distance_____
2. Stopping Distance_____
3. Total Stopping Distance_____

Violator's Speed _____

1. Reaction Distance_____
2. Stopping Distance_____
3. Total Stopping Distance_____

Violator's Speed _____

1. Reaction Distance_____
2. Stopping Distance_____
3. Total Stopping Distance_____

Violator's Speed _____

1. Reaction Distance_____
2. Stopping Distance_____
3. Total Stopping Distance_____

Violator's Speed _____

1. Reaction Distance_____
2. Stopping Distance_____
3. Total Stopping Distance_____

Violator's Speed _____

1. Reaction Distance_____
2. Stopping Distance_____
3. Total Stopping Distance_____

# SPEED LIMIT WORKSHEET

Speed Limit_____

Violator's Speed _____

1. Reaction Distance_____/_____
2. Stopping Distance_____/_____
3. Total Stopping Distance_____/_____
4. % Over Speed Limit_____
5. % Farther to Stop_____

Speed Limit_____

Violator's Speed _____

1. Reaction Distance_____/_____
2. Stopping Distance_____/_____
3. Total Stopping Distance_____/_____
4. % Over Speed Limit_____
5. % Farther to Stop_____

Speed Limit_____

Violator's Speed _____

1. Reaction Distance_____/_____
2. Stopping Distance_____/_____
3. Total Stopping Distance_____/_____
4. % Over Speed Limit_____
5. % Farther to Stop_____

Speed Limit_____

Violator's Speed _____

1. Reaction Distance_____/_____
2. Stopping Distance_____/_____
3. Total Stopping Distance_____/_____
4. % Over Speed Limit_____
5. % Farther to Stop_____

Speed Limit_____

Violator's Speed _____

1. Reaction Distance_____/_____
2. Stopping Distance_____/_____
3. Total Stopping Distance_____/_____
4. % Over Speed Limit_____
5. % Farther to Stop_____

Speed Limit_____

Violator's Speed _____

1. Reaction Distance_____/_____
2. Stopping Distance_____/_____
3. Total Stopping Distance_____/_____
4. % Over Speed Limit_____
5. % Farther to Stop_____

# SPEED AND RANGE ESTIMATION WORKSHEET

Name_____ Location_____

Date_____ Time_____

| Speed Est. | Range Est. | Speed Est. | Speed Actual | Range Actual | Difference Speed | Difference Range |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| Total | Total | Total | Total | Total | Total | Total |

Total of All Speed ÷ 10 = Range of Speed Estimates

"My ability to estimate speeds averaged within_____mph in a structured test."

Total of All Ranges ÷ 10 = Range of Distance Estimates

"My ability to estimate range averaged within_____feet in a structured test."

# TRACKING HISTORY

Visual

1._____

2._____

3._____

4._____

Audio

1._____

2._____

Unit Confirmation

1._____

2._____

## BEAM WIDTH COMPUTATIONS

$$BW = 2D(TAN\frac{1}{2}\angle)$$

| | (∠) TRANSMISSION ANGLE | (*D*) DISTANCE | (*BW*) BEAM WIDTH |
|---|---|---|---|
| 1. | 12° | 105 | FT. |
| 2. | 12° | 286 | FT. |
| 3. | 16° | 116 | FT. |
| 4. | 16° | 306 | FT. |
| 5. | 18° | 96 | FT. |
| 6. | 18° | 319 | FT. |
| 7. | 24° | 84 | FT. |
| 8. | 24° | 510 | FT. |
| 9. | 9° | 686 | FT. |
| 10. | 9° | 544 | FT. |
| 11. | 12° | 1467 | FT. |
| 12. | 24° | 1270 | FT. |
| 13. | 9° | 1619 | FT. |
| 14. | 18° | 1598 | FT. |
| 15. | 16° | 1321 | FT. |

# DOPPLER SHIFT COMPUTATIONS

Compute the correct speeds in miles per hour given the following Doppler shift.

K- Band Transmitted Signal: 24,150,000,000 CPS

$Difference = Transmitted - Returned$

To calculate Doppler shift to speed: $72CPS = 1mph$

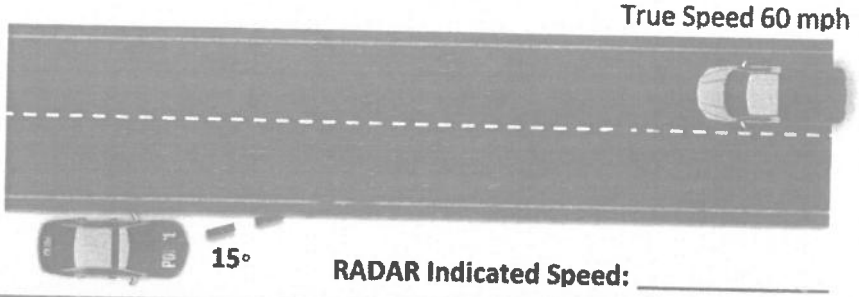
Example: $3000 \div 72 = 41mph$

| | Returned Signal | Difference | Miles Per Hour | Toward or Away |
|---|---|---|---|---|
| 1. | 24,150,002,880 | 2880 CPS | | |
| 2. | 24,149,998,488 | 1512 CPS | | |
| 3. | 24,150,005,616 | 5616 CPS | | |
| 4. | 24,150,003,960 | 3960 CPS | | |
| 5. | 24,149,994,816 | 5184 CPS | | |
| 6. | 24,149,992,362 | | | |
| 7. | 24,150,008,280 | | | |
| 8. | 24,149,996,760 | | | |
| 9. | 24,149,990,280 | | | |
| 10. | 24,150,010,800 | | | |

Look at the returned signal for each problem and determine whether the target is moving toward the source or away from the source.

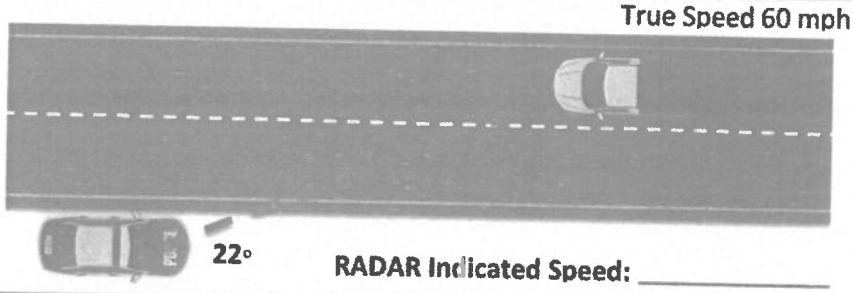
# STATIONARY COSINE EFFECT WORKSHEET

True Speed 60 mph



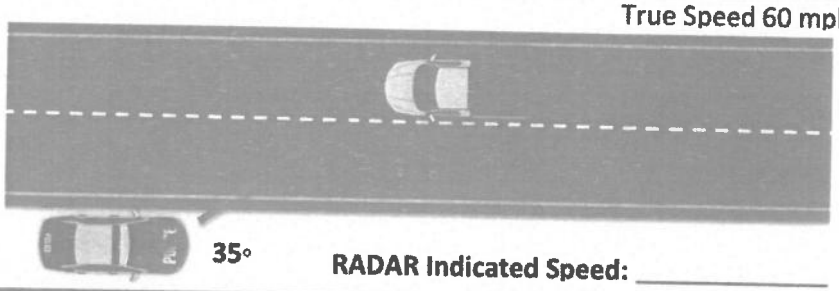
15° RADAR Indicated Speed: _____

True Speed 60 mph



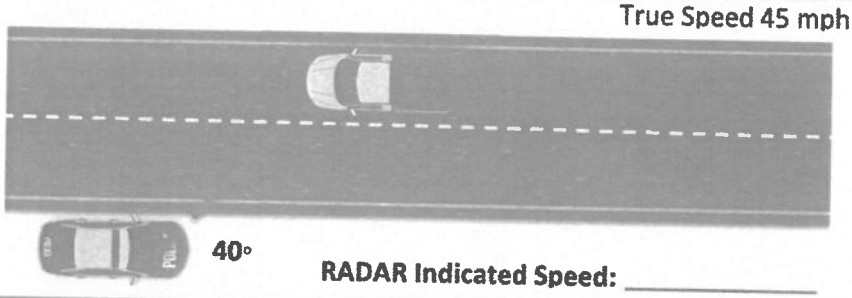
22° RADAR Indicated Speed: _____

True Speed 60 mph



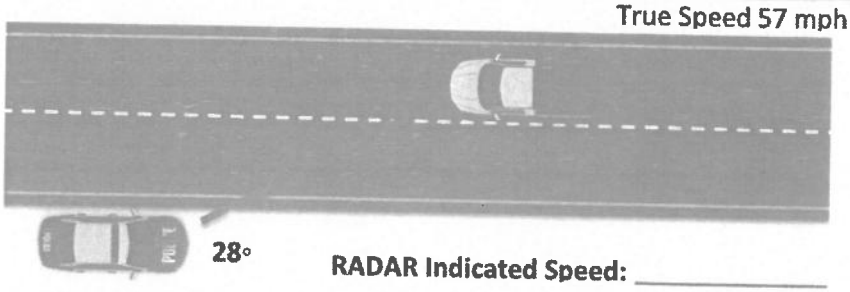
35° RADAR Indicated Speed: _____

True Speed 45 mph



40° RADAR Indicated Speed: _____

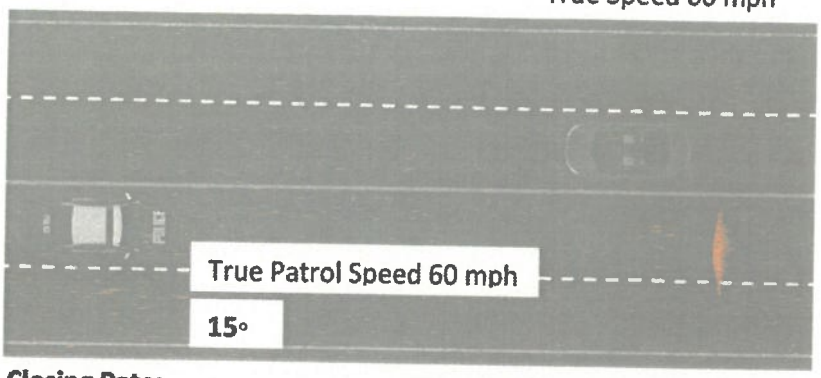
True Speed 57 mph



28° RADAR Indicated Speed: _____

# MOVING COSINE EFFECT WORKSHEET

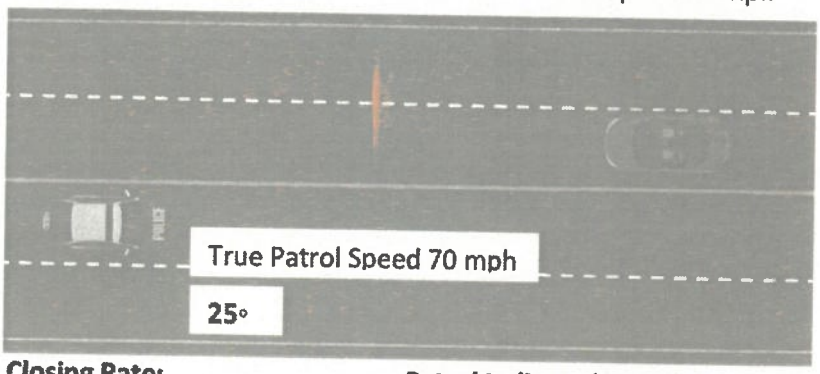
True Speed 60 mph




**Closing Rate:** _____ **Patrol Indicated Speed:** _____

**Target Indicated Speed:** _____

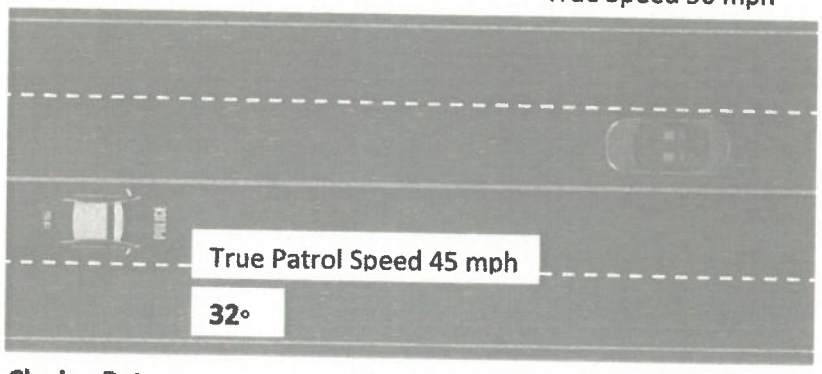
True Speed 65 mph




**Closing Rate:** _____ **Patrol Indicated Speed:** _____

**Target Indicated Speed:** _____

True Speed 50 mph

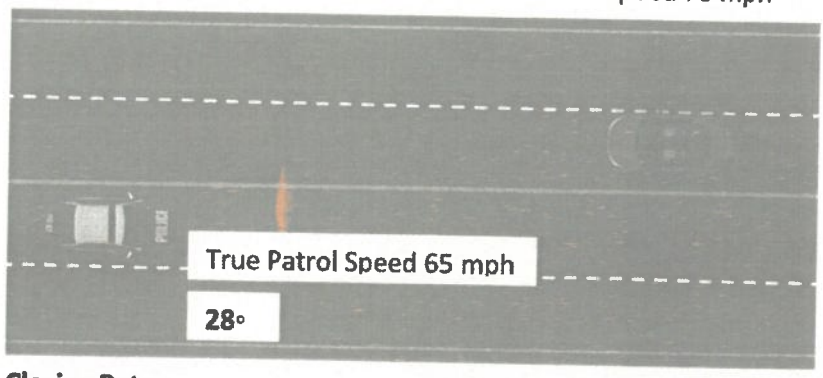



**Closing Rate:** _____ **Patrol Indicated Speed:** _____

**Target Indicated Speed:** _____

# MOVING COSINE EFFECT WORKSHEET

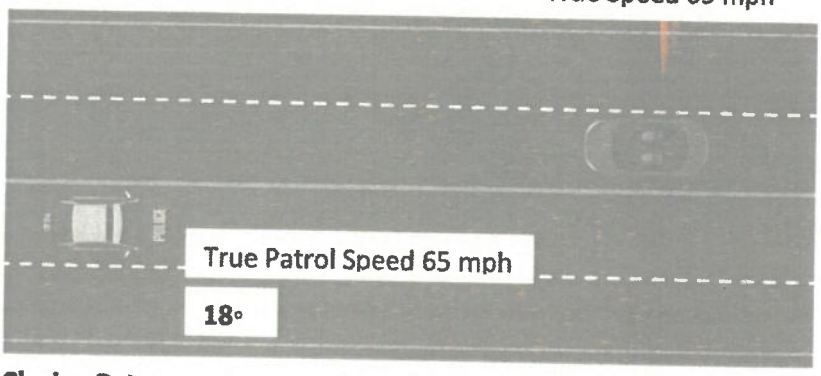
True Speed 70 mph




**Closing Rate:** _____ **Patrol Indicated Speed:** _____

**Target Indicated Speed:** _____

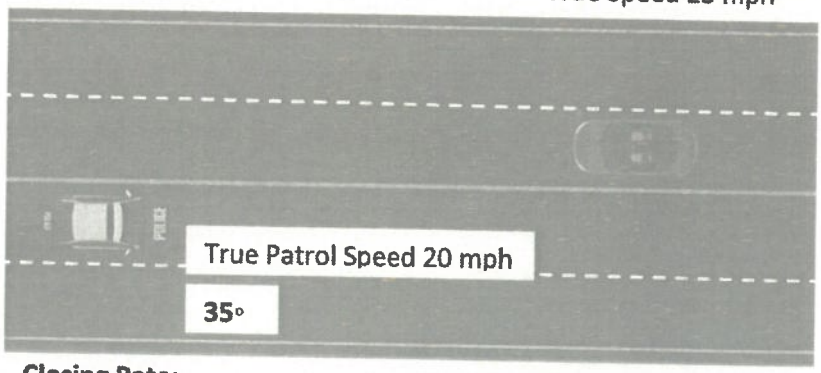
True Speed 65 mph




**Closing Rate:** _____ **Patrol Indicated Speed:** _____

**Target Indicated Speed:** _____

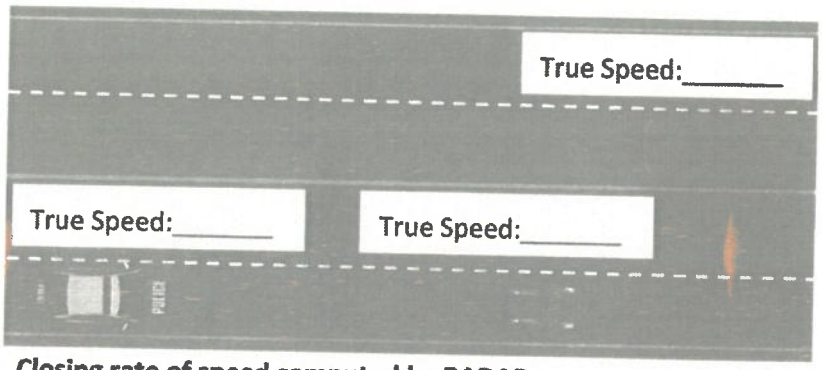
True Speed 23 mph




**Closing Rate:** _____ **Patrol Indicated Speed:** _____

**Target Indicated Speed:** _____

# SHADOWING EFFECT WORKSHEET




**Closing rate of speed computed by RADAR:** _____

**Patrol vehicle speed displayed by RADAR:** _____

**Target vehicle speed displayed by RADAR:** _____