Geometry 21 PROOFS – ch.2 Name _____ Per____ Date_____

Four types of proofs in this packet...

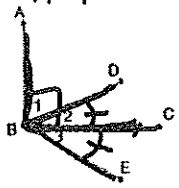
- I. Basic Proofs using only vocabulary from ch. 1 and ch. 2 ("Reasons" are properties and definitions only)
- II. Proofs using some Postulates and Properties that don't require proof themselves
- III. Proofs ***OF*** the Theorems from ch. 2 (2.5 and 2.6)
- IV. Proofs ***USING*** the vocabulary and theorems from ch.1 and ch. 2 ("Reasons" are theorems, properties, postulates, and definitions)

I. PROOFS USING VOCABULARY TERMS ONLY...

(complementary, supplementary, midpoint, bisect, perpendicular, congruent, right angle...)

A. Given: $\overline{AB} \perp \overline{CB}$, $\overline{BC}$ bisects < DBE

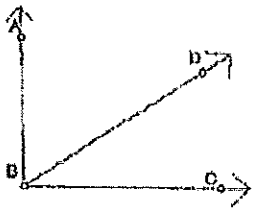
Prove: <1 and <3 are complementary



STATEMENTS	REASONS
1) $\overline{AB} \perp \overline{CB}$	1) Given
2) ∠ABC is a rt. ∠	2) Defn. ⊥
3) m<ABC = 90°	3) defn. right angle
4) m<1 + m<2 = m<ABC	4) Angle Add. Post.
5) m<1 + m<2 = 90	5) Substitution POE
6) $\overline{BC}$ bisects < DBE	6) Given
7) ∠2 ≅ ∠3	7) Defn. bisect
8) m<2 = m<3	8) Defn. ≅
9) m<1 + m<3 = 90°	9) Substitution
10) ∠1 & ∠3 are comp.	10) Defn. complementary

B. Given: <ABD and <DBC are complementary;
m<ABD = x + 30; m<DBC = 3x

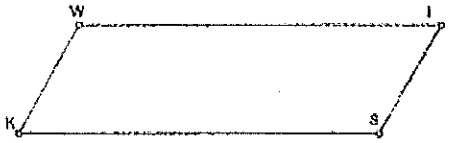
Prove: x = 15



STATEMENTS	REASONS
1) <ABD and <DBC are complementary; m<ABD = x + 30; m<DBC = 3x	1) Given
2) m<ABD + m<DBC = 90	2) Defn. Complem.
3) x+30 + 3x = 90	3) Substitution POE
4) 4x + 30 = 90	4) Simplify
5) 4x = 60	5) Subtraction
6) x = 15	6) Division

C. **Given:** <K and <S are supplementary; m<K = m<I

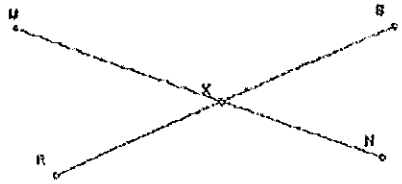
Prove: m<S = 180 – m<I



STATEMENTS	REASONS
1) <K and <S are supplementary; m<K = m<I	1) Given
2) m<K + m<S = 180	2) Defn. Supp.
3) m<I + m<S = 180	3) Substitution
4) m<S = 180 - m<I	4) Subtraction

D. **Given:** X is the midpoint of $\overline{MN}$; MX = RX

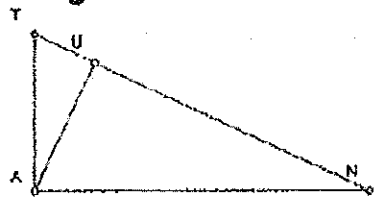
Prove: XN = RX



STATEMENTS	REASONS
1) X is the midpoint of $\overline{MN}$	1) Given
2) $\overline{MX} \cong \overline{XN}$	2) Defn. midpt.
3) MX = XN	3) Defn. ≅
4) MX = RX	4) given
5) RX = XN	5) Substitution / Transitive
6) XN = RX	6) Symmetric

E. **Given:** $\overline{AU} \perp \overline{TN}$; $\overline{TA} \perp \overline{AN}$

Prove: <TUA and <TAN are supplementary



STATEMENTS	REASONS
1) $\overline{AU} \perp \overline{TN}$; $\overline{TA} \perp \overline{AN}$	1) Given
2) <TUA and <TAN are right angles	2) Defn. ⊥
3) m<TUA = 90 m<TAN = 90	3) Defn. rt. ∠'s
4) 90 + 90 = 180	4) simplify (known math fact)
5) m<TUA + m<TAN = 180	5) Substitution
6) <TUA & <TAN are suppl.	6) Defn. Supp.

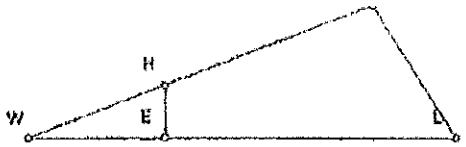
F. **Given:** <1 and <2 are complementary; m<2 = m<3

Prove: <1 and <3 are complementary

STATEMENTS	REASONS
1) <1 and <2 are complementary	1) Given
2) m<1 + m<2 = 90	2) Defn. comple.
3) m<2 = m<3	3) Given
4) m<1 + m<3 = 90	4) substitution POE
5) <1 and <3 are comple.	5) Defn. of complem.

G. Given: $\overline{HE} \perp \overline{WL}$; m<HEW = m<A

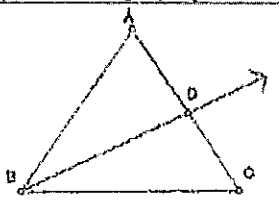
Prove: m<A =90°



STATEMENTS	REASONS
1) $\overline{HE} \perp \overline{WL}$	1) Given
2) ∠ HEW is a rt. ∠	2) Defn. ⊥
3) m<HEW = 90	3) Defn. rt. ∠
4) m<HEW = m<A	4) Given
5) m<A =90	5) Substit. or Transitive

H. Given: $\overrightarrow{BD}$ bisects <ABC; m<ABD + m<C = 90

Prove: <DBC and <C are complementary



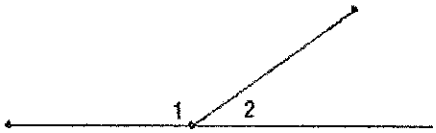
STATEMENTS	REASONS
1) $\overrightarrow{BD}$ bisects <ABC	1) Given
2) ∠ ABD ≅ <DBC	2) Defn. bisect
3) m<ABD = m<DBC	3) Defn. ≅
4) m<ABD + m<C = 90	4) Given
5) m<DBC + m<C = 90	5) Substitution
6) <DBC & <C are complem.	6) Defn. Comple.

II. PROOFS USING POSTULATES AND PROPERTIES – postulates are accepted as true without proof, but we can use them in proofs. (Linear Pair Postulate, Transitive Property, Angle/Segment Addition Post...)

❖ *LINEAR PAIR POSTULATE PROOFS (or Linear Pair Property...same thing!)*

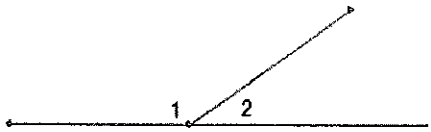
I. Given: m<1 = 138

Prove: m<2 = 42



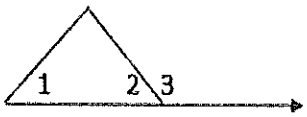
STATEMENTS	REASONS
1) m<1 = 138	1) Given
2) <1 and <2 form a linear pair	2) Defn. Lin Pr
3) <1 & <2 are supplementary	3) Linear Pair Postulate
4) m<1 + m<2 = 180	4) Defn. supplem.
5) 138 + m<2 = 180	5) Substitution
6) m<2 = 42	6) Subtraction

J. **Given:** m<1 = 5y – 3; m<2 = 2y + 1
Prove: y = 26



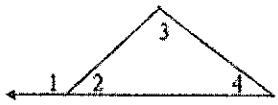
STATEMENTS	REASONS
1) m<1 = 5y-3 ; m<2 = 2y+1	1) Given
2) <1 and <2 are a linear pair	2) Defn. Lin. Pr.
3) < 1 and < 2 are supplementary	3) Linear Pair Postulate
4) m<1 + m<2 = 180	4) Defn. Supplem.
5) 5y-3 + 2y+1 = 180	5) Substitution POE
6) 7y - 2 = 180	6) Simplfy
7) 7y = 182	7) Addition POE
8) y = 26	8) Division "

K. **Given:** m<1 + m<3 = 180
Prove: <1 ≅ <2



STATEMENTS	REASONS
1) m<1 + m<3 = 180	1) Given
2) < 2 and < 3 form a linear pair	2) Defn. Lin Pr.
3) <2 & <3 are supplem.	3) Lin. Pr. Post.
4) m<2 + m<3 = 180	4) Defn. Supplem.
5) m<1 + m<3 = m<2 + m<3	5) Substitution (or transitive)
6) m<1 = m<2	6) Subtraction
7) <1 ≅ <2	7) Defn. ≅

L. **Given:** m<2 + m<3 + m<4 = 180
Prove: m<1 = m<3 + m<4



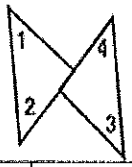
STATEMENTS	REASONS
1) m<2 + m<3 + m<4 = 180	1) Given
2) <1 and <2 are a lin. pr.	2) Defn. of Linear Pair
3) <1 and <2 are supplem	3) Lin. Pr. Post.
4) m<1 + m<2 = 180	4) Defn. Supplem.
5) m<1 + m<2 = m<2 + m<3 + m<4	5) Substitution (or transitive)
6) m<1 = m<3 + m<4	6) Subtraction

M. Given: m<2 + m<3 + m<4 = 180
Prove: m<1 = m<3 + m<4

STATEMENTS	REASONS
1)	1)
2) < 2 and < 3 form a linear pair	2)
3)	3)
4)	4)
5) m<1 + m<3 = m<2 + m<3	5) Substitution (or transitive)
6)	6)
7)	7)

❖ *TRANSITIVE PROPERTY PROOFS*

N. Given: m<3 = 40°; <1 ≅ <2 ; <2 ≅ <3
Prove: m<1 = 40°

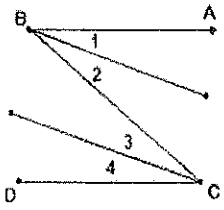


STATEMENTS	REASONS
1) <1 ≅ <2 ; <2 ≅ <3	1) Given
2) m<1=m<2 ; m<2=m<3	2) Defn. of congruent
3) m<1 = m<3	3) Transitive Prop. (or Subst.)
4) m<3=40	4) given
5) m<1 = 40	5) Transitive / (or Substitution)

***There will be more proofs using transitive property in some proofs that involve other THEOREMS (III.)

❖ *ANGLE ADDITION POSTULATE PROOF*

O. Given: <1 ≅ <3 ; <2 ≅ <4
Prove: <ABC ≅ <BCD



STATEMENTS	REASONS
1) <1 ≅ <3 ; <2 ≅ <4	1) Given
2) m<1=m<3 ; m<2=m<4	2) Defn. of congruent
3) m<1 + m<2 = m<3 + m<2	3) Add. Prop. =
4) m<1 + m<2 = m<3 + m<4	4) Substitution
5) m<1 + m<2 = m<ABC; m< 3+m<4=m<BCD	Angle Add. Post.
6) m<ABC = m<BCD	6) substitution POE
7) <ABC ≅ <BCD	7) Defn. ≅

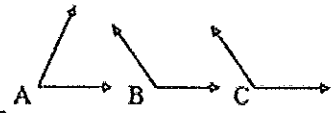
III. PROOFS OF THEOREMS ~ Geo 21 (proofs packet cont'd) Name _____ per____

❖ PROOF OF CONGRUENT SUPPLEMENTS THEOREM

If (GIVEN) 2 angles are supplementary to the same (or to congruent) angles
Then (PROVE) the 2 angles are congruent to each other.

*(****since this is the proof of the theorem, you can't use that theorem as any of the reasons!)*

P. **Given:** <A and <B are supplementary
<A and <C are supplementary
Prove: <B ≅ <C



STATEMENTS	REASONS
1) <A and <B are supplementary <A and <C are supplementary	1) Given
2) $m\angle A + m\angle B = 180$ $m\angle A + m\angle C = 180$	2) Defn. of supplem.
3) m<A + m<B = m<A + m<C	3) Substitution
4) $m\angle B = m\angle C$	4) subtraction POE
5) $\angle B \cong \angle C$	5) Defn. ≅

❖ PROOF OF VERTICAL ANGLES THEOREM

If (GIVEN) 2 angles are vertical angles
Then (PROVE) the 2 angles are congruent to each other.

*(****since this is the proof of the theorem, you can't use that theorem as any of the reasons!)*

Q. **Given:** < 1 and <2 are vertical angles
Prove: <1 ≅ <2

STATEMENTS	REASONS
1) $\angle 1$ & $\angle 2$ are vertical $\angle$'s	1) Given
2) <1 and <3 are a linear pair <2 and <3 are a linear pair	2) Defn. of Lin. Pr.
3) $\angle 1$ & $\angle 3$ are supplem. $\angle 2$ and $\angle 3$ are supplem.	3) Lin. Pr. Post.
4) $\angle 1 \cong \angle 3$	4) Congruent Supplements Theorem

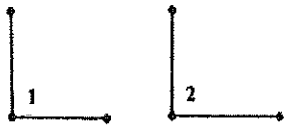
**In class we proved Vertical Angles Theorem without the congruent supplements theorem, but now that we have learned that theorem, we may as well use it to make our proof shorter!

❖ PROOF OF RIGHT ANGLES THEOREM

If (GIVEN) 2 angles are right angles,
Then (PROVE) the 2 angles are congruent to each other.

*(****since this is the proof of the theorem, you can't use that theorem as any of the reasons!)*

R. **Given:** <1 is a right angle
<2 is a right angle
Prove: <1 ≅ <2



STATEMENTS	REASONS
1) <1 is a right angle; <2 is a right angle	1) Given
2) $m\angle 1 = 90$ $m\angle 2 = 90$	2) Defn. of right $\angle$.
3) $m\angle 1 = m\angle 2$	3) substitution
4) $\angle 1 \cong \angle 2$	4) Defn. ≅

❖ PROOF OF CONGRUENT COMPLEMENTS THEOREM

If (GIVEN) 2 angles are complementary to the same (or to congruent) angles
Then (PROVE) the 2 angles are congruent to each other.

*(****since this is the proof of the theorem, you can't use that theorem as any of the reasons!)*

S. **Given:** ∠2 and ∠4 are complementary
∠3 and ∠5 are complementary
∠4 ≅ ∠5
Prove: ∠2 ≅ ∠3

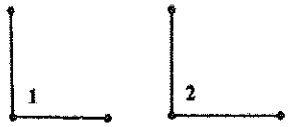
STATEMENTS	REASONS
1) ∠2 and ∠4 complem. ∠3 and ∠5 are complem.; ∠4 ≅ ∠5	1) Given
2) m∠2 + m∠4 = 90 m∠3 + m∠5 = 90	2) Defn. of complem.
3) m∠2 + m∠4 = m∠3 + m∠5	3) Substitution
4) m∠4 = m∠5	4) defn. of congruent
5) m∠2 + m∠4 = m∠3 + m∠4	5) Substitution
6) m∠2 = m∠3	6) Subtraction
7) ∠2 ≅ ∠3	7) Defn. ≅

❖ PROOF OF THEOREM that states IF 2 ANGLES ARE SUPPLEMENTARY AND CONGRUENT, THEN THEY ARE BOTH RIGHT ANGLES

If (GIVEN) 2 angles are supplementary and congruent,
Then (PROVE) the 2 angles are right angles.

*(****since this is the proof of the theorem, you can't use that theorem as any of the reasons!)*

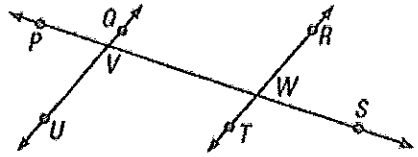
T. **Given:** ∠1 ≅ ∠2; ∠1 is supplementary to ∠2
Prove: ∠1 is a right angle
∠2 is a right angle



STATEMENTS	REASONS
1) ∠1 ≅ ∠2 ; ∠1 suppl. ∠2	1) Given
2) m∠1 = m∠2	2) definition of congruent
3) m∠1 + m∠2 = 180	3) definition of supplementary
4) m∠1 + m∠1 = 180 ; m∠2 + m∠2 = 180	4) Substitution
5) 2(m∠1) = 180 ; 2(m∠2) = 180	5) simplify
6) m∠1 = 90 ; m∠2 = 90	6) Division
7) ∠1 is a rt. ∠ ; ∠2 is a rt. ∠	7) Defn. right ∠

IV. EXAMPLES OF PROOFS USING THOSE THEOREMS

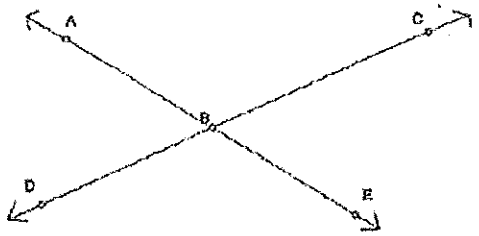
Now a proof USING the Congruent Supplements Theorem



U. Given: <QVW and <RWV are supplementary
Prove: <QVP ≅ <RWV

STATEMENTS	REASONS
1) <QVW & <RWV are supplem	1) Given
2) <QVW and <QVP are a linear pair	2) Defn. Lin. Pr.
3) <QVW and <QVP are supplementary	3) Lin. Pr. Post.
4) <QVP ≅ <RWV	4) Congruent Supplements Theorem

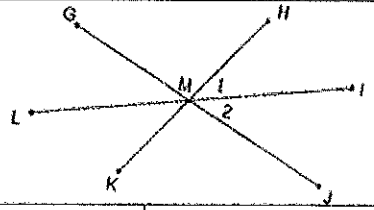
Now some proofs USING the Vertical Angles Theorem



V. Given: m<ABC = 2x – 3 ; m<EBD = 85
Prove: x = 44

STATEMENTS	REASONS
1) m<ABC = 2x-3 ; m<EBD = 85	1) Given
2) <ABC and <EBD are vert. &'s	2) definition of vertical angles
3) <ABC ≅ < DBE	3) Vert. &. Thm.
4) m<ABC = m< DBE	4) definition of congruent
5) 2x – 3 = 85	5) Substitution
6) 2x = 88	6) Add. POE
7) X = 44	7) Division

W. Given: <1 ≅ <2
Prove: $\overline{ML}$ bisects $\angle GMK$



STATEMENTS	REASONS
1) <1 and <LMK are vertical angles <2 and <GML are vertical angles	1) Defn. of vert. &'s (hint: not 'given')
2) <LMK ≅ <1	2) Vert. & Thm
3) <1 ≅ <2	3) given
4) <2 ≅ <GML	4) Vert. & Thm
5) <LMK ≅ <GML	5) transitive prop. of congruence
6) ML bisects <GMK	6) Defn. bisect

Now some proofs USING the Congruent Complements Theorem

X. **Given:** <3 and <2 are complementary; m<1 + m<2 = 90
Prove: <1 ≅ <3

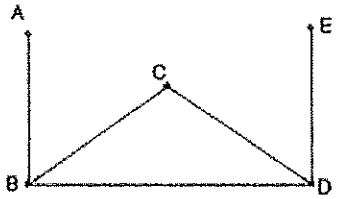
→First without using Congr. Compl. Thm.

STATEMENTS	REASONS
1) <3 and <2 are complem.; m<1 + m<2 = 90	1) Given
2) m<3 + m<2 = 90	2) Defn. Complem.
3) m<1 + m<2 = m<3 + m<2	3) Substitution
4) m<1 = m<3	4) subtraction
5) <1 ≅ <3	5) Defn. ≅

→Now shorter WITH Congr. Compl. Thm

STATEMENTS	REASONS
1) <3 and <2 are complem.; m<1 + m<2 = 90	1) Given
2) <1 and <2 are complem.	2) Defn. complem.
3) <1 ≅ <3	3) Congruent Complem. Thm.

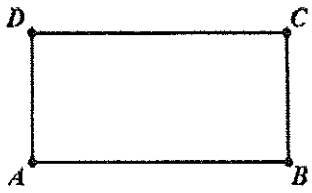
Y. **Given:** <ABD is a right angle; <EDB is a right angle
m<CBD = m<CDB
Prove: <ABC ≅ <EDC



STATEMENTS	REASONS
1) <ABD is a rt. ∠; <EDB is a rt. ∠; m<CBD = m<CDB	1) Given
2) m<ABD = 90; m<EDB = 90	2) definition of right angle
3) m<ABC + m<CBD = m<ABD; m<EDC + m<CDB = m<EDB	3) Angle Add. Post.
4) m<ABC + m<CBD = 90; m<EDC + m<CDB = 90	4) Substitution
5) <ABC and <CBD are complementary; <EDC and <CDB are complementary	5) Defn. complementary
6) <CBD ≅ <CDB	6) (hint: look at the given) Defn. ≅
7) <ABC ≅ <EDC	7) Congr. Complem. Thm.

Now a proof USING the Right Angles Theorem

Z. **Given:** <DAB is a right angle; <ABC is a right angle; <ABC ≅ <BCD
Prove: <DAB ≅ <BCD



STATEMENTS	REASONS
1) <DAB is a right angle; <ABC is a right angle	1) Given
2) <DAB ≅ <ABC	2) right angles theorem
3) <ABC ≅ <BCD	3) given
4) <DAB ≅ <BCD	4) Transitive

Name ANSWERS Period: ____ Date: ____

Geometry 21 2.2 and 2.3 Extra Practice

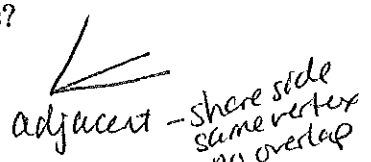
1. A **conditional** is a(n) if-then statement.

2. If a conditional is **false**, you can give a counterexample to show it is false.

3. 3a) A statement is considered a **definition** if the original conditional **AND** its converse are both true.

   3b) If they are **BOTH** true, then you can write the statement as a biconditional which contains the phrase if and only if.

4. Draw an example of **adjacent angles** and an example of non-adjacent angles. Why are they / are they not adjacent angles?



5. Use the following statement for questions the following questions: ***All poodles are dogs.***

a. Write this as a conditional
   If it is a poodle, then it is a dog.

b. State the hypothesis it is a poodle

c. State the conclusion it is a dog.

d. Write the converse
   If it is a dog, then it is a poodle.

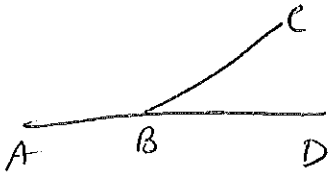
e. Write the inverse
   If it is NOT a poodle, then it is NOT a dog.

f. Write the contrapositive
   If it is Not at dog, then it is not a poodle.

g. Draw a Venn diagram for the above example.

6. Draw a picture of a linear pair and name the angles that form it:

   ∠ ABC and ∠ CBD form a linear pair



7. Circle the answer: A linear pair is (sometimes, always or never) a pair of adjacent angles.

8. Circle the answer: If the conditional is true, the (inverse, converse, contrapositive) must be true as well.

9. Re-write the following statement as a **conditional, converse, inverse** and **contrapositive.** Give the truth value of each statement, if it is false, give a counterexample.

All squares are quadrilaterals.

Conditional: If it is a square, then it is a quadril.

Converse: If it is a quadr., then it is a square

Inverse: If it is NOT a square, then it is not a quadr.

Contrapositive: If it is not a quadr., then it is not a square

10. Use the following statement to answer the following: **A right angle has a measure of 90°.**

a. Re-write the statement as a **conditional** and **converse.**

Conditional: If it is a right ∠, then it has a meas. = 90.

Converse: If it has a meas. = 90, then it is a right ∠

b. Is the statement a good definition? Yes or no? Why? If yes, write it as a biconditional.

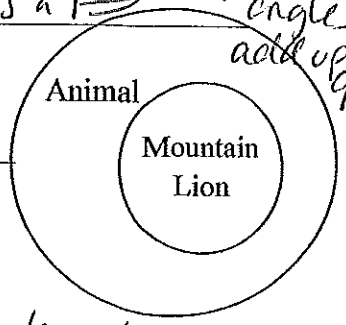
Reversible, can be written as biconditional b/c cond. & conv. both true

11. What is the difference between a right angle and complementary angles?

a right ∠ is ONE angle meas. = 90; Complementary is a pair (2) of angles add up to 90!

12. Write the **conditional statement** represented by the given diagram:

If it is a Mountain Lion, then it is an animal



*13. **Write the two statements that form the biconditional.***

Two lines are perpendicular if and only if they intersect to form four right angles.

Conditional: If the 2 lines are perpendicular, then they intersect to form 4 right ∠'s

Converse: If the 2 lines intersect to form 4 right ∠'s then they are ⊥.

14. Use the definitions of p, q, and r to write each conditional statement below in symbolic form. (p,q,r)

p: The weather is rainy. q: The sky is cloudy. r: The ground is wet.

a. If the weather is not rainy, then the sky is not cloudy. $\sim p \rightarrow \sim q$

b. If the ground is wet, then the weather is rainy. $r \rightarrow p$

c. If the sky is not cloudy, then the ground is wet. $\sim q \rightarrow r$

Geometry **Formative Quiz 2.5** (3) Name ANSWERS per _____

Name the property of equality that justifies each statement:

1) AB + BC = AC
AC = EF + GH
AB + BC = EF + GH
Transitive / Subst.

2) m<A = 90
m<B = 90
m<A = m<B
Substitution / trans

3) m<A = m<B
m<B = m<A
Symmetric

4) x + 4 = -3
x = -7
Subtraction

5) 5x = 7
$x = \frac{7}{5}$
Division

8) 3x + 7 = 12
3x = 5
Subtraction

9) 2(x+5) = 13
2x + 10 = 13
Distribute

8) AB = CD
AB + EF = CD + EF
Add. POE

9) m<A + m<B = 180
m<B = 30
m<A + 30 = 180
Substitution

10) $\frac{1}{2}$m<F = $\frac{1}{2}$ m<G
m<F = m<G
Mult.

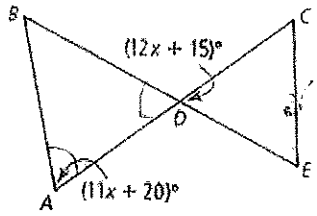
→ → → →

11. Given: $9 = 4x - 3(x - 2)$ Prove: $x = 3$

Statements	Reasons
1. $9 = 4x - 3(x - 2)$	1 Given
2. $9 = 4x - 3x + 6$	2 Distrib.
3. $9 = x + 6$	3 Simplify
4. $6 = 6$	4 Reflexive
5. $3 = x$	5 Subtraction
6. $x = 3$	6 Symmetric

12. Given: $\angle A \cong \angle BDA$

Prove: $12x + 15 = 11x + 20$



Statements	Reasons
1) $\angle A \cong \angle BDA$	1) given
2) $\angle BDA \cong \angle CDE$ vert. $\angle$s	2) Defn. of vertical <'s
3) $\angle BDA \cong \angle EDC$	3) Vertical <'s Thm.
4) $\angle A \cong \angle CDE$	4) Transitive
5) $m\angle A = m\angle CDE$	5) Defn. of congruent
6) $11x + 20 = 12x + 15$	6) Substitution

Geometry **PRACTICE for PROOFS - chapter 2** Name ANSWERS date ____ per. ____

Fill in the reasons that justify each step. The reasons on this page will be a Property of Equality.

1. $2(x-3)=3x-9$	1. Given
2. $2x-6=3x-9$	2. Distributive
3. $-6=x-9$	3. Subtraction
4. $3=x$	4. Addition
5. $x=3$	5. Symmetric

1. $4(x-3)+9=2x+1$	1. Given
2. $4x-12+9=2x+1$	2. Distrib.
3. $4x-3=2x+1$	3. Simplify **
4. $2x-3=1$	4. Subtraction
5. $2x=4$	5. Addition
6. $x=2$	6. Division

1. $2(x-7)=8(2x+3)+1$	1. Given
2. $2x-14=16x+24+1$	2. Distributive
3. $2x-14=16x+25$	3. Simplify
4. $-14=14x+25$	4. Subtraction
5. $-39=14x$	5. Subtraction
6. $-\frac{39}{14}=x$	6. Division

1. $ST=12$	1. Given
2. $QR+ST=52$	2. Given
3. $QR+12=52$	3. Substitution
4. $QR=40$	4. Subtraction

1. $m\angle A=30°$	1. Given
2. $m\angle A+m\angle C=75°$	2. Given
3. $30°+m\angle C=75°$	3. Substitution
4. $m\angle C=45°$	4. Subtraction

1. $AB=9x+5$, $BC=x-7$, $AC=25$	1. Given
2. $AB+BC=AC$	2. Given
3. $9x+5+x-7=25$	3. Substitution
4. $10x-2=25$	4. Simplify
5. $10x=27$	5. Addition
6. $x=2.7$	6. Division

1. $m\angle A=m\angle B$	1. Given
2. $m\angle B=m\angle C$	2. Given
3. $m\angle A=80°$	3. Given
4. $m\angle A=m\angle C$	4. Transitive (or Sub)
5. $80°=m\angle C$	5. Substitution
6. $m\angle C=80°$	6. Symmetric

1. $m\angle ABC+m\angle CBD=m\angle ABD$	1. Given
2. $m\angle ABC=3x+1$, $m\angle CBD=24°$, $m\angle ABD=5x-7$	2. Given
3. $3x+1+24=5x-7$	3. Substitution
4. $3x+25=5x-7$	4. Simplify
5. $25=2x-7$	5. Subtraction
6. $32=2x$	6. Addition
7. $16=x$	7. Division
8. $x=16$	8. Symmetric

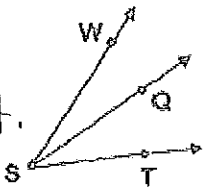
Postulates and definitions can also be used as justifications in proofs.

Here are some examples of postulates used in proofs:

1.

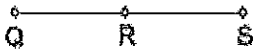
1. $XR + RW = XW$ — 1. Seg. Add. Post.

2.



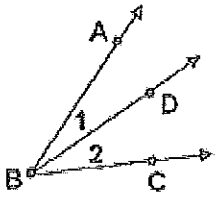
1. $m\angle WSQ + m\angle QST = m\angle WST$ — 1. Angle Add. Post.

3.



1. R is the midpoint of $\overline{QS}$ — 1. Given
2. $\overline{QR} \cong \overline{RS}$ — 2. Defn. midpt.

4.



1. $\overrightarrow{BD}$ bisects $\angle ABC$ — 1. Given
2. $\angle 1 \cong \angle 2$ — 2. Defn. bisect

5.
1. $\angle S$ and $\angle W$ are complementary — 1. Given
2. $m\angle S + m\angle W = 90°$ — 2. Defn. complem.

6.

1. $AB = 5$, $AC = 18$ — 1. Given
2. $AB + BC = AC$ — 2. Segment Add. Post.
3. $5 + BC = 18$ — 3. Substitution
4. $BC = 13$ — 4. Subtraction

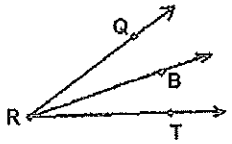
7.
1. $\overline{AB} \cong \overline{RT}$ — 1. Given
2. $AB = RT$ — 2. Defn $\cong$

8.
1. $AB = RT$ — 1. Given
2. $\overline{AB} \cong \overline{RT}$ — 2. Defn. $\cong$

9.

1. B is the midpoint of $\overline{AC}$ — 1. Given
2. $\overline{AB} \cong \overline{BC}$ — 2. Defn. midpt.
3. $AB = BC$ — 3. Defn. $\cong$
4. $AB = 5$ — 4. Given
5. $5 = BC$ — 5. Substitution
6. $BC = 5$ — 6. Symmetric

10.



1. $m\angle QRB = 15°$, $m\angle BRT = 17°$ — 1. Given
2. $m\angle QRB + m\angle BRT = m\angle QRT$ — 2. Angle Addition Post.
3. $15° + 17° = m\angle QRT$ — 3. Substitution
4. $32° = m\angle QRT$ — 4. Simplify
5. $m\angle QRT = 32°$ — 5. Symmetric

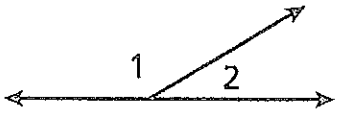
11. Given: $\angle A$ is complementary to $\angle C$, $m\angle A = 30°$

Prove: $m\angle C = 60°$

Statements	Reasons
1. $\angle A$ is complementary to $\angle C$	1. Given
2. $m\angle A + m\angle C = 90°$	2. Defn. complem.
3. $m\angle A = 30°$	3. Given
4. $30° + m\angle C = 90°$	4. Substitution
5. $m\angle C = 60°$	5. Subtraction

12. **Given:** $m\angle 2 = 32°$

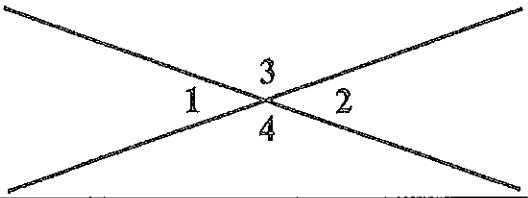
Prove: $m\angle 1 = 148°$



STATEMENTS	REASONS
1) $m\angle 2 = 32$	1) Given
2) $\angle 1$ and $\angle 2$ form a linear pair	2) Defn. Lin. Pr.
3) $\angle 1$ and $\angle 2$ are supplementary	3) Linear Pair Postulate
4) $m\angle 1 + m\angle 2 = 180$	4) Defn. supplementary
5) $m\angle 1 + 32 = 180$	5) substitution Prop =
6) $m\angle 1 = 148$	7) Subtraction

13) **Given:** $m\angle 3 = 152°$

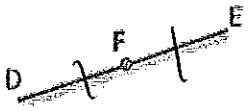
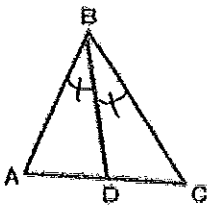
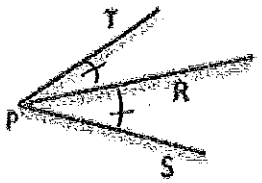
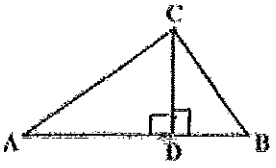
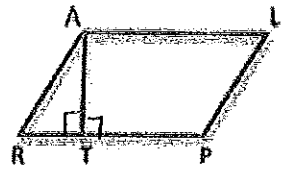
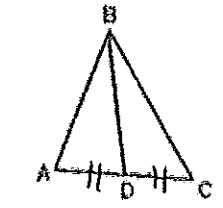
Prove: $m\angle 4 = 152°$



STATEMENTS	REASONS
1) $m\angle 3 = 152$	1) Given
2) $\angle 3$ and $\angle 4$ are vertical $\measuredangle$'s	2) Defn. of vertical $\measuredangle$'s
3) $\angle 3 \cong \angle 4$	3) Vert $\measuredangle$'s Thm
4) $m\angle 3 = m\angle 4$	4) Defn. $\cong$
5) $m\angle 4 = 152$	5) Substitution

Instructions:

1. Draw the appropriate markings on the diagram to indicate the given information (hatch marks, perpendicular markings, etc.)
2. Write or complete the conclusion.
3. State the reason for the conclusion

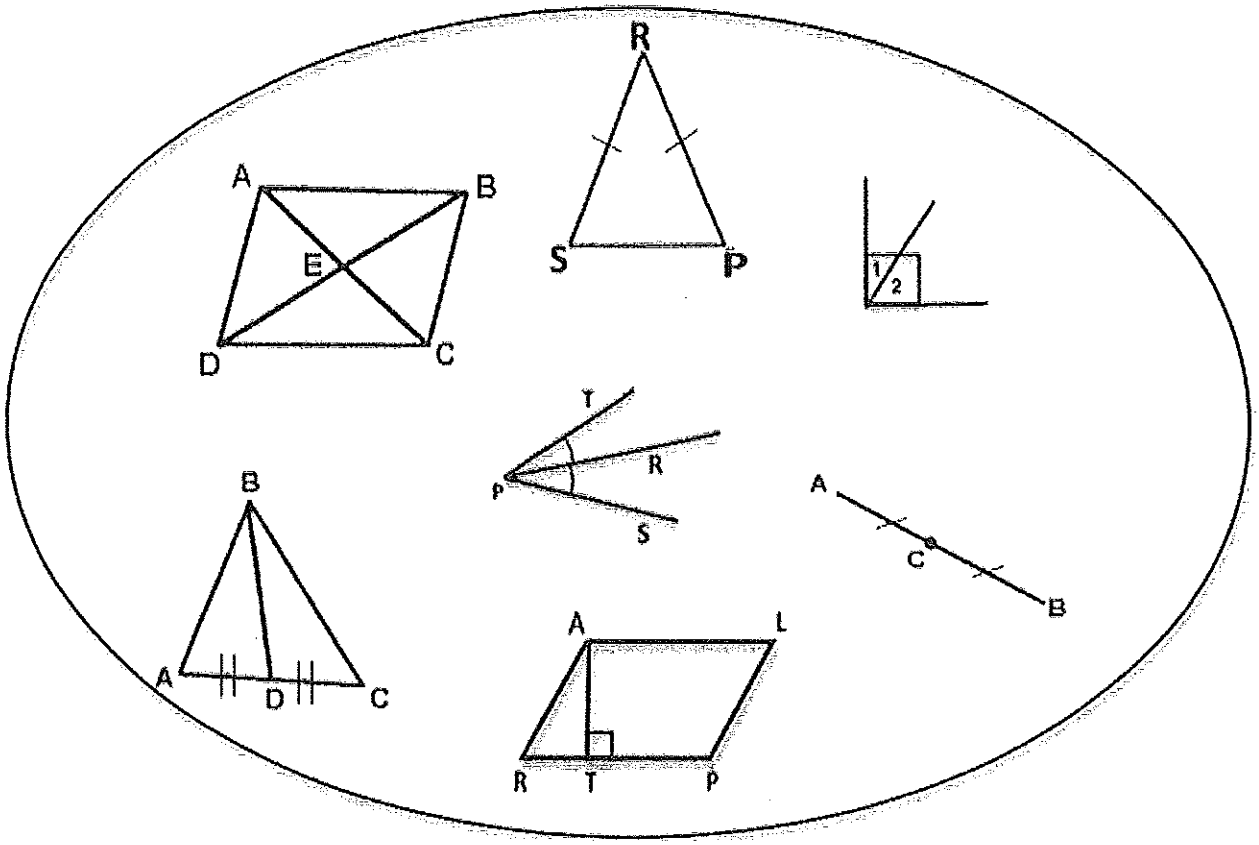
11 	Given: C is the midpoint of $\overline{AB}$ Conclusion: $\overline{AC} \cong$? $\overline{CB}$ Reason: Defn. midpt.
12 	Given: F is the midpoint of $\overline{DE}$ Conclusion: $\overline{DF} \cong \overline{FE}$ Reason: Defn. midpt.
13 	Given: $\overline{DB}$ bisects $\angle ABC$ Conclusion: $\angle ABD \cong$? $\angle DBC$ Reason: Defn. bisect
14 	Given: $\overline{PR}$ bisects $\angle TPS$ Conclusion: $\angle TPR \cong \angle RPS$ Reason: Defn. of bisect
15 	Given: $\overline{CD} \perp \overline{AB}$ Conclusion: $\angle ADC$ is ? a right $\angle$ Reason: Defn. $\perp$
16 	Given: $\overline{AT} \perp \overline{RP}$ Conclusion: $\angle RTA$ is ~~right~~ a right $\angle$ Reason: Defn. of $\perp$
17 	Given: $\overline{BD}$ is a median (D is midpoint) Conclusion: $\overline{DC} \cong$? $\overline{AD}$ Reason: Defn. midpoint (or median)

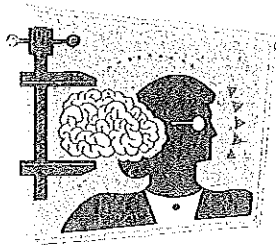
Basic Geometry: Fundamentals Needed For Proofs

Name: ANSWERS Date:_____

Use the diagrams in the oval below to answer:

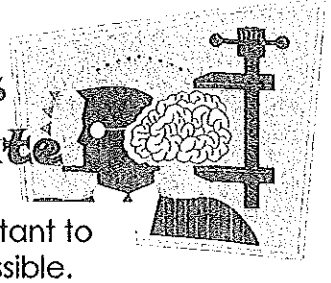
1	Name an angle bisector.	$\overline{PR}$
2	Name a median.	$\overline{BD}$
3	Name a pair of complementary angles.	$\angle 1$ & $\angle 2$
4	Name two perpendicular segments.	$\overline{AT} \perp \overline{RP}$
5	Name a pair of congruent angles.	$\angle TPR \cong \angle RPS$
6	Name a pair of congruent line segments.	$\overline{AC} \cong \overline{CB}$
7	Name a pair of supplementary angles.	$\angle AED$ and $\angle AEB$
8	Name a pair of vertical angles.	$\angle AED$ & $\angle BEC$
9	Name a point that is a midpoint.	point C (or pt D)
10	Name an isosceles triangle.	$\triangle RSP$





Introduction to Proofs

Name_____ Period____ Date_____



When you are completing proofs in geometry it is important to "squeeze" as much information from our givens as possible. Assume that every statement below is the beginning of a new proof. What information could you conclude?

***Disclaimer: When you are completing full proofs you may not always need to use each given or necessarily go as far as you need to on this page.*

1. $m\angle 1 = m\angle 2$ — GIVEN

$\angle 1 \cong \angle 2$	Defn of $\cong$

2. $m\angle 1 + m\angle 5 = 90$ degrees — GIVEN

$\angle 1$ & $\angle 5$ are complem.	Defn. complem.

3. $\angle 1$ and $\angle 7$ form a linear pair — GIVEN(or defn. of lin. pr. from diagram)

$\angle 1$ & $\angle 7$ are supplem.	Defn. L.P.
$m\angle 1 + m\angle 7 = 180$	Defn. supplem.

4. $\angle 8$ is a rt angle and $\angle 9$ is a rt angle — GIVEN

$m\angle 8 = 90$ $m\angle 9 = 90$	Defn. rt. $\angle$
$m\angle 8 = m\angle 9$	Substitution

5. $\angle 4$ and $\angle 7$ are complementary — GIVEN

$m\angle 4 + m\angle 7 = 90$	Defn. complem.

6. $\angle 1 \cong \angle 7$ — GIVEN

$m\angle 1 = m\angle 7$	Defn. $\cong$

7. $m\angle 1 + m\angle 4 = 180$ degrees — GIVEN

$\angle 1$ & $\angle 4$ are supplem.	Defn. supplem.

8. $\angle 8$ and $\angle 9$ are vertical angles — GIVEN(or defn. of vert. < from diagram)

$\angle 8 \cong \angle 9$	Vert. $\angle$'s Thm
$m\angle 8 = m\angle 9$	Defn. $\cong$

9. ∠3 and ∠8 are supp. angles — GIVEN

$m\angle 3 + m\angle 8 = 180$	Defn. supplem.

10. ∠8 and ∠10 are both complementary to ∠7 — GIVEN

$\angle 8 \cong \angle 10$	Congr. Complem. Thm

11. ∠1 and ∠2 are supplementary — GIVEN

$m\angle 1 + m\angle 2 = 180$	Defn. supplem.

12. ∠1 and ∠5 are supplementary — GIVEN

$m\angle 1 + m\angle 5 = 180$	Defn. supplem.

13. ∠ABC is a right angle — GIVEN

$m\angle ABC = 90$	Defn. rt. ∠

14. DB = SG — GIVEN

$\overline{DB} \cong \overline{SG}$	Defn. $\cong$

15. ∠H and ∠P form a linear pair — GIVEN (or defn. of _____ from diagram)

$\angle H$ & $\angle P$ are supplem.	Lin. Pr. Post.
$m\angle H + m\angle P = 180$	Defn. supplem.

16. $\overline{MA} = \overline{TH}$ — GIVEN

$MA = TH$	Defn. $\cong$

17. m∠ABC = 147; m∠JLM = 147 — GIVEN

$m\angle ABC = m\angle JLM$	Substitution
$\angle ABC \cong \angle JLM$	Defn. $\cong$

18. TI = FG, FG = SD — GIVEN

$TI = SD$	Transitive

19. ∠DMB is a right angle — GIVEN

$m\angle DMB = 90$	Defn. rt. ∠

20. ∠3 and ∠7 are comp; ∠6 and ∠7 are comp — GIVEN

$\angle 6 \cong \angle 3$	Congr. Comp. Thm
$m\angle 6 = m\angle 3$	Defn. $\cong$

21. ∠QWE and ∠MNB are supp; ∠WSZ and ∠MNB are supp — GIVEN

$\angle QWE \cong \angle WSZ$	Congr. supp. Thm
$m\angle QWE = m\angle WSZ$	Defn. $\cong$

22. m∠7 = 30 ; m ∠8 = 30 — GIVEN

$m\angle 7 = m\angle 8$	Substitution
$\angle 7 \cong \angle 8$	Defn. $\cong$

23. ∠1 ≅ ∠8 — GIVEN

$m\angle 1 = m\angle 8$	Defn. $\cong$

24. AB = DC; DC = EF; EF =GH; GH =IJ — GIVEN

$AB = IJ$	Transitive

25. ∠MJR is a rt angle; ∠TUV is a rt angle — GIVEN

$\angle MJR \cong \angle TUV$	Right ∠ Thm
$m\angle MJR = m\angle TUV$	Defn. $\cong$

Name ANSWERS Period Date

Geometry **Practice with 2.5 – Reasoning in Algebra and Geometry**

1. Write a conclusion that can be drawn from each of the following statements.

a. $\angle A \cong \angle B$ $m\angle A = m\angle B$

b. $EF = GH$ $\overline{EF} \cong \overline{GH}$

c. l bisects $\overline{AB}$ at point M $\overline{AM} \cong \overline{MB}$

d. $\angle A$ is a right angle $m\angle A = 90°$

e. $\angle 1$ and $\angle 2$ are supplementary $m\angle 1 + m\angle 2 = 180°$

f. $\angle 1$ and $\angle 2$ form a linear pair $\angle 1$ & $\angle 2$ supplem.

g. $\overline{AB} \perp \overline{BC}$ $\angle ABC$ is a rt. $\angle$ ($m\angle ABC = 90°$)

h. $\angle 1$ and $\angle 2$ are vertical angles $\angle 1 \cong \angle 2$

i. $m\angle 1 = 50$, $m\angle 2 = 40$, $m\angle 3 = m\angle 1$ $m\angle 3 = 50°$

j. $\angle ABC$ and $\angle XYZ$ are congruent and supplementary $\angle ABC$ & $\angle XYZ$ are rt $\angle$'s

k. C is the midpoint of $\overline{AB}$ $\overline{AC} \cong \overline{CB}$

2. State the property that justifies each statement.

a. If $\angle 1 \cong \angle 2$ and $\angle 2 \cong \angle 3$, then $\angle 1 \cong \angle 3$. Trans. Prop. $\cong$

b. $XY = XY$ Reflexive POE

c. If $5 = x$, then $x = 5$. Symmetric POE

d. If $2x + 5 = 11$, then $2x = 6$. Subtraction POE (5)

e. If $a + 10 = 20$, then $a = 10$. Subtraction POE (10)

f. If $\frac{x}{3} = -15$, then $x = -45$. Mult. Prop. $\cong$ (3)

g. If $4x - 5 = x + 12$, then $4x = x + 17$. Addition POE (5)

h. If $\frac{1}{5}BC = \frac{1}{5}DE$, then $BC = DE$. Mult. POE (5)

i. If $5(x + 7) = -3$, then $5x + 35 = -3$. Distributive Prop.

j. If $m\angle 1 = 25°$ and $m\angle 2 = 25°$, then $m\angle 1 = m\angle 2$. Substitution POE

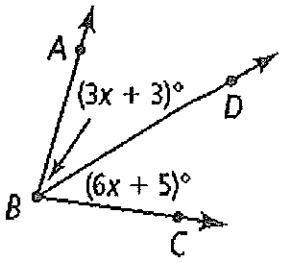
k. If $\overline{AB} \cong \overline{BC}$ and $\overline{BC} \cong \overline{CD}$, then $\overline{AB} \cong \overline{CD}$. Transitive Prop. $\cong$

l. If $3(x - \frac{2}{3}) = 4$, then $3x - 2 = 4$ Distributive Prop

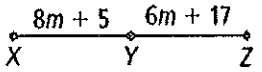
3. Fill in the reason that justifies each step.

a. $0.25x + 2x + 12 = 39$ — Given
$2.25x + 12 = 39$ — a. Simplify.
$2.25x = 27$ — b. Subtraction (12)
$225x = 2700$ — c. Mult. POE (100)
$x = 12$ — d. Division POE (225)

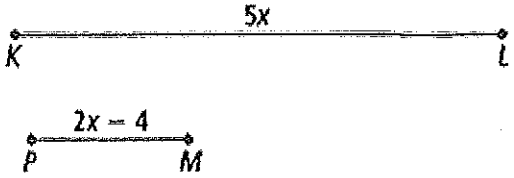
b. $m\angle ABC = 80$ — Given
$m\angle ABD + m\angle DBC = m\angle ABC$ — Angle Addition Postulate
$(3x + 3) + (6x + 5) = 80$ — a. Substitution POE
$9x + 8 = 80$ — b. Simplify
$9x = 72$ — c. Subtraction POE
$x = 8$ — d. Division POE



c. $XY = YZ$ — Given
$8m + 5 = 6m + 17$ — a. Given (diagram)
$2m + 5 = 17$ — b. Subtraction (6m)
$2m = 12$ — c. Subtraction (5)
$m = 6$ — d. Division POE (2)



d. $KL = 3(PM)$ — Given
$5x = 3(2x - 4)$ — a. Substitution
$5x = 6x - 12$ — b. Distributive
$-x = -12$ — c. Subtraction
$x = 12$ — d. Multiplication



4. **Name the property of equality or congruence that justifies going from the first statement to the second statement.**

a. $\overline{XY} \cong \overline{TZ}$
$\overline{TZ} \cong \overline{XY}$ Symmetric Prop. $\cong$

b. $3(x+2)=15$
$3x+6=15$ Distributive

c. $4n+6-2n=9$
$2n+6=9$ Simplify

d. $\angle A \cong \angle B$ and $\angle B \cong \angle C$
$\angle A \cong \angle C$ Transitive Prop. $\cong$

5. **Complete the following algebraic proofs.**

a. Given: $\frac{8-3x}{4}=32$ Prove: $x=-40$

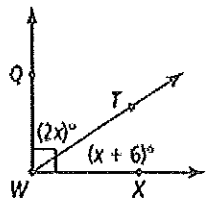
Statements	Reasons
1. $\frac{8-3x}{4}=32$	1. Given
2. $8-3x=128$	2. Mult. POE (4)
3. $-3x=120$	3. Subtraction Prop. of Eq.
4. $x=-40$	4. Divisim POE

b. Given: $\frac{1}{5}x+3=2x-24$ Prove: $x=15$

Statements	Reasons
1. $\frac{1}{5}x+3=2x-24$	1. Given
2. $x+15=10x-120$	2. Multiplication Prop. of Eq.
3. $15=9x-120$	3. Subtraction Prop. of Eq.
4. $135=9x$	4. Add. Prop. Eq.
5. $15=x$	5. Division Prop. of Eq.
6. $x=15$	6. Symmetric Property of Eq.

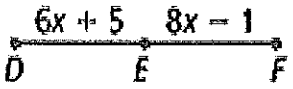
6. **Complete the following proofs.**

a. Given: $\angle QWT$ and $\angle TWX$ are complementary
Prove: $x = 28$



Statements	Reasons
1. $\angle QWT$ and $\angle TWX$ are complementary	1. Given
2. $m\angle QWT = (2x)°$ and $m\angle TWX = (x+6)°$	2. Given
3. $m\angle QWT + m\angle TWX = 90°$	3. Defn. complem.
4. $2x + x + 6 = 90°$	4. Substitution
5. $3x + 6 = 90°$	5. Simplify
6. $3x = 84$	6. Subtraction
7. $x = 28$	7. Division

Given: E is the midpoint of $\overline{DF}$; DE = 6x + 5 ; EF = 8x - 1
Prove: $x = 3$



Statements	Reasons
1. $DE = 6x + 5$ and $EF = 8x - 1$	1. Given
2. E is the midpoint of $\overline{DF}$	2. Given
3. $\overline{DE} \cong \overline{EF}$	3. Defn. midpt.
4. $DE = EF$	4. Defn. $\cong$
5. $6x + 5 = 8x - 1$	5. Substitution
6. $5 = 2x - 1$	6. Subtraction (6x)
7. $6 = 2x$	7. Addition (1)
8. $3 = x$	8. Division (2)
9. $x = 3$	9. Symmetric

Geometry

PROOFS: *Practice using Postulates and Definitions in Proofs* Name ANSWERS

(ch 1 & 2 ~ seg. add. post., angle add. post, lin. prs., suppl., compl., midpoint, bisect, vertical angles, right angles)

SEGMENT ADDITION POSTULATE:

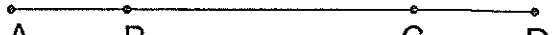
If 

then, AB + BC = AC

Proof using Segment Addition Postulate;

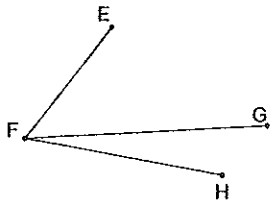
Given: AB = CD

Prove: $\overline{AC} \cong \overline{BD}$



STATEMENTS	REASONS
1) AB = CD	1) Given
2) AB + BC = CD + BC	2) Add. POE (BC)
3) AB + BC = AC BC + CD = BD	3) Segment Addition Postulate
4) AC = BD	4) Substitution
5) $\overline{AC} \cong \overline{BD}$	5) Defn. $\cong$

ANGLE ADDITION POSTULATE:

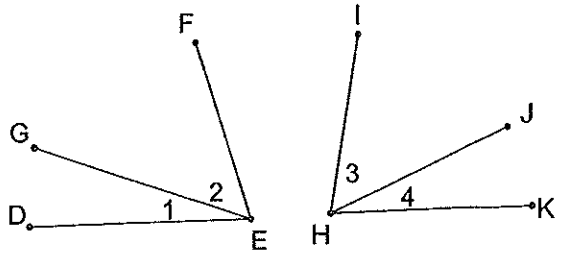
If 

then m∠EFG + m∠GFH = m∠EFH

Proof using Angle Addition Postulate:

Given: $\angle DEF \cong \angle IHK$; $\angle 1 \cong \angle 3$

Prove: $\angle 2 \cong \angle 4$

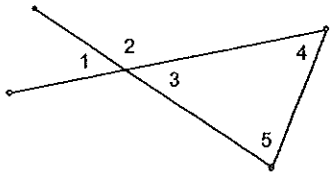


STATEMENTS	REASONS
1) $\angle DEF \cong \angle IHK$; $\angle 1 \cong \angle 3$	1) given
2) $m\angle DEF = m\angle IHK$; $m\angle 1 = m\angle 3$	2) defn. congruence
3) $m\angle 1 + m\angle 2 = m\angle DEF$; $m\angle 3 + m\angle 4 = m\angle IHK$	3) angle addition postulate
4) m∠1 + m∠2 = m∠3 + m∠4	4) Substitution
5) m∠1 + m∠2 = m∠1 + m∠4	5) Substitution
6) m∠2 = m∠4	6) Subtraction (of 2)
7) $\angle 2 \cong \angle 4$	7) definition of congruence

LINEAR PAIRS:

Definition of Linear pair (the definition just describes what they look like, so...diagram)
Linear Pair Postulate: If 2 ∠'s form a linear pair, then they are supplementary

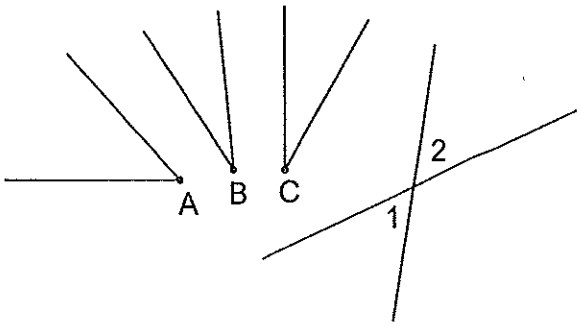
Proof using LINEAR PAIRS



Given: diagram at right
Prove: m∠2 = m∠4 + m∠5

Statements	Reasons
1)	1) given
2) ∠2 and ∠3 form a linear pr.	2) Defn. Lin. Pr.
3) ∠2 & ∠3 are supplem.	3) Linear Pair Postulate
4) m∠2 + m∠3 = 180	4) Defn. supplem.
5) m∠3 + m∠4 + m∠5 = 180	5) triangle sum theorem (the 3 ∠'s of a triangle add up to 180)
6) m∠2 + m∠3 = m∠3 + m∠4 + m∠5	6) Substitution
7) m∠2 = m∠4 + m∠5	7) subtraction POE

COMPLEMENTARY ANGLES:



Given: $\angle B \cong \angle C$
∠A and ∠B are complementary
∠2 and ∠C are complementary
Prove: $m\angle A = m\angle 1$

STATEMENTS	REASONS
1) ∠B ≅ ∠C; ∠A, ∠B complem.; ∠2, ∠C complem.	1) given
2) m∠B = m∠C	2) Defn. ≅
3) m∠A + m∠B = 90 m∠2 + m∠C = 90	3) definition of complementary
4) m∠A + m∠B = m∠2 + m∠C	4) Substitution POE
5) m∠A + m∠B = m∠2 + m∠B	5) substitution
6) m∠A = m∠2	6) Subtraction POE
7) ∠1 and ∠2 are vertical angles	7) Defn. Vert. ∠'s
8) ∠1 ≅ ∠2	8) Vertical angles theorem
9) m∠1 = m∠2	9) Defn. ≅
10) m∠1 = m∠A	10) Substitution
11) m∠A = m∠1	11) Symmetric