

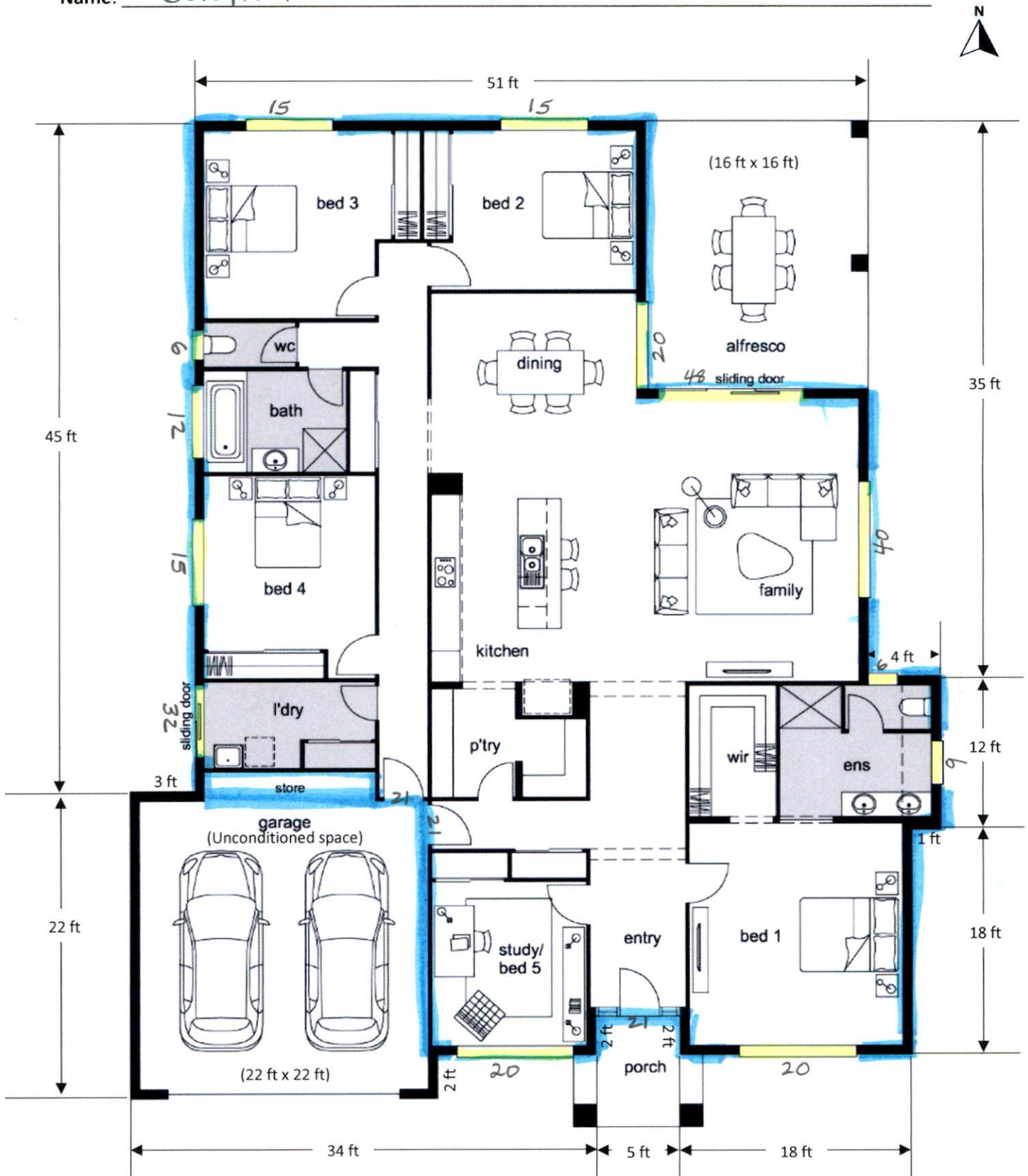
Homework #5

Due: 9/8

Show all work for full credit.

20 pts total

Name: Solution



Window Specifications

All windows are Double Glass

Dining	5 ft x 4 ft
Family	8 ft x 5 ft
Bed 1	5 ft x 4 ft
Bed 2, Bed 3, and Bed 4	5 ft x 3 ft
Study/bed 5	5 ft x 4 ft
Bath	4 ft x 3 ft and 2 ft x 3 ft
Ens	3 ft x 3 ft and 2 ft x 3 ft

Building Construction

Floor	SOG (edge insulation)
Walls	R-19 (6" Insulation)
Ceilings	R-30 (10" insulation)
Wood Frame Walls	
Attic Space	
Average Ceiling Height	10 ft
Porch	7 ft x 7 ft
Furnace	90% Efficiency Loss

Door Specifications

Entry Door	7 ft x 3 ft (wood no storm door)
Garage Doors	7 ft x 3 ft (Wood no storm door)

Double Glass Patio Doors:

Sliding door	6 ft x 8 ft
Sliding door (l'dry)	4 ft x 8 ft

Note: Garage Area is unconditioned space

SHOW ALL WORK FOR FULL CREDIT.**Part 1: Cooling Load (Heat gain)**

- For the five-bedroom, two-bathroom house shown, write the square footage of each window along the outside of the window and the square footage of the entry door, garage doors, and sliding doors (patio) next to the doors on the floor plan. (See class example)
- Determine the total wall perimeter:

Wall Side	Length (ft) [Show calculations]
North	$51 + 4 = 55$
South	$19 + 12 + 5 + 18 + 1 = 55$
East	$35 + 12 + 18 + 2 = 67$
West	$45 + 20 + 2 = 67$
Total Wall Perimeter	244 ft

Determine the total Glass Area (Includes Sliding Doors):

Side	Glass Area (ft ²) [Show calculations]
North	$15 + 15 + 48 + 6 = 84$
South	$20 + 20 = 40$
East	$20 + 40 + 9 = 69$
West	$6 + 12 + 15 + 32 = 65$
Total Glass Area	258 ft ²

Determine the total Door Area:

Door	Door Area (ft ²) [Show calculations]
Wood No Storm Door	21 + 21 + 21
Total Door Area	63 ft ²

3. Determine the Net Wall Area.

$$\begin{aligned} \text{Net Wall Area} &= 244 \text{ ft} \times 10 \text{ ft} - 258 \text{ ft}^2 - 63 \text{ ft}^2 \\ &= 2119 \text{ ft}^2 \end{aligned}$$

4. Determine the Ceiling Area.

$$\begin{aligned} \text{Ceiling Area} &= (58 \text{ ft} \times 67 \text{ ft}) - (3 \times 45) - (16 \times 16) - (4 \times 35) - (1 \times 18) \\ &\quad - (2 \times 35) - (2 \times 5) - (22 \times 22) \\ &= 3886 \text{ ft}^2 - 1113 \text{ ft}^2 \\ &= 2,773 \text{ ft}^2 \end{aligned}$$

Part 2: Heat Load (Heat Loss)

Item	Area (ft ²)
Total sq. ft. of Double Glass Windows	178
Total sq. ft. of Double Glass Patio (Sliding Doors)	80
Total sq. ft. of Wood No Storm Doors	63

5. Using the attached Accu-Size Heating & Cooling Home Analysis Form complete the Cooling Load (heat gain) and the Heating Load (heat loss) for the home.

Accu-Size Heating & Cooling Home Analysis

Cooling Load (Heat Gain) - 95 Degree Day

ft ² of Windows		Heat Gain
North (single)	x 26 =	
North (double)	<u>84</u> x 21 =	<u>1764</u>
NE & NW (single)	x 45 =	
NE & NW (double)	x 35 =	
E & W (single)	x 60 =	
E & W (double)	<u>134</u> x 49 =	<u>6566</u>
SE & SW (single)	x 50 =	
SE & SW (double)	x 40 =	
South (single)	x 36 =	
South (double)	<u>40</u> x 25 =	<u>1000</u>
ft ² of Doors		Heat Gain
Wood (no storm door)	<u>63</u> x 13 =	<u>819</u>
Wood (w/storm door)	x 9 =	
Insulated Metal Door	x 6 =	
ft ² of Net Walls		Heat Gain
Wall perimeter <u>244</u> x <u>10</u> Wall Height <u>2440</u> less <u>321</u> glass & door area = net wall area <u>2119</u> ft ²		
No insulation	x 8 =	
R-13 (3 1/2") Insulation	x 3 =	
R-19 (6" Insulation)	<u>2119</u> x 2 =	<u>4238</u>
ft ² of Ceiling		Heat Gain
No insulation	x 22 =	
R-11 (3") Insulation	x 4.1 =	
R-19 (6" Insulation)	x 2.6 =	
R-30 (10" Insulation)	<u>2773</u> x 1.6 =	<u>4437</u>
ft ² of Floor		Heat Gain
No insulation	x 3 =	
Carpet No Insulation	x 2 =	
R-11 (3" Insulation)	x 1 =	
Floor on Slab	<u>2773</u> x 0 =	<u>0</u>
Infiltration / Ventilation		Heat Gain
Home ft ² <u>2773</u> x 3.5 =		<u>9706</u>
Internal Gains		Heat Gain
Number of People <u>6</u> x 530 =		<u>3180</u>
Kitchen & Bath Allowance		<u>1250</u>
Subtotal BTU/h heat gain		<u>31,710</u>
Gains from Duct Work		Heat Gain
In crawl space - (subtotal BTU/h x .09) =		
In attic - (subtotal BTU/h x .13) =		<u>4122</u>
Total BTU/h heat gain		<u>35,832</u>

Heat Load (Heat Loss) - 0 Degree Day

ft ² of Windows		Heat Loss
Single Glass	x 97 =	
Double Glass	<u>178</u> x 69 =	<u>12,282</u>
ft ² of Doors		Heat Loss
Single Glass Patio	x 99 =	
Double Glass Patio	<u>80</u> x 72 =	<u>5760</u>
Wood No Storm Door	<u>63</u> x 75 =	<u>4725</u>
Wood w/Storm Door	x 46 =	
Insulated Metal Door	x 35 =	
ft ² of Net Walls		Heat Loss
Frame (no insulation)	x 20 =	
Frame (3 1/2" insulation)	x 7 =	
Frame (6" insulation)	<u>2119</u> x 5 =	<u>10,595</u>
Masonry (no insulation)	x 37 =	
Masonry (1" insulation)	x 11 =	
ft ² of Ceiling		Heat Loss
No insulation	x 25 =	
R-11 (3") Insulation	x 7 =	
R-19 (6" Insulation)	x 4 =	
R-30 (10" Insulation)	<u>2773</u> x 3 =	<u>8319</u>
ft ² of Floor Over Crawl Space		Heat Loss
No insulation	x 19 =	
Carpet no Insulation	x 9 =	
R-11 (3+)" Insulation)	x 6 =	
ft ² of Floor Over Basement		Heat Loss
No insulation	x 2 =	
Carpet or Insulation	x 1 =	
Perimeter of Slab Floor		Heat Loss
Slab (no insulation)	x 57 =	
Slab (edge Insulation)	<u>244</u> x 22 =	<u>5368</u>
Infiltration / Ventilation		Heat Loss
Home ft ² <u>2773</u> x 4.9 =		<u>13,588</u>
Subtotal BTU/h Heat Loss		<u>60,637</u>
Losses From Ductwork		Heat Loss
In crawl space - (subtotal BTU/h x .10) =		
In attic - (subtotal BTU/h x .08) =		<u>4851</u>
Total BTU/h Heat Loss		<u>65,488</u>
80% Furnace Efficiency Loss x 0.25 =		
90% Furnace Efficiency Loss X 0.12 =		<u>7859</u>
Total BTU/h Heat input needed		<u>73,347</u>