Homework #5   Due: 9/8
Show all work for full credit.
20 pts total
Name: Solution

N

51 ft

15   15

bed 3   bed 2   (16 ft x 16 ft)

alfresco

45 ft   6   wc   20

            12   bath   dining   48 sliding door   36 ft

                 bed 4   family

            15   40

                 kitchen

            32   l'dry   6 4 ft

sliding door   p'try   wir   ens

3 ft   store   20 ft

                 21   1 ft

garage
(Unconditioned space)   study/   entry   bed 1   18 ft
22 ft   bed 5

            21

            21

(18 ft x 22 ft)   2 ft   20   2 ft 21 2 ft   20
                                        porch

30 ft   5 ft   16 ft
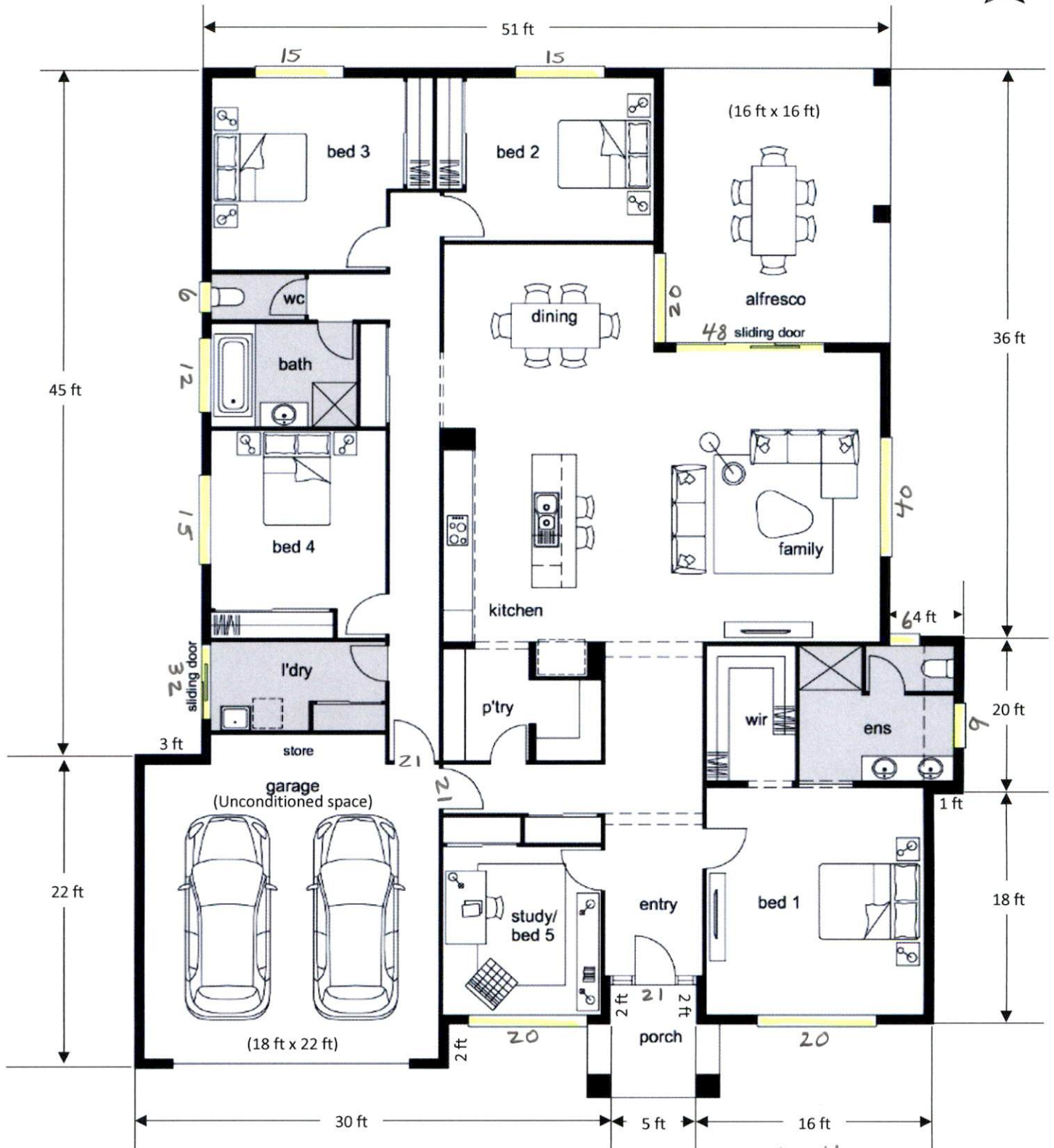
(should have
been 22ft)

1

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)

1. 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)

2. Determine the total wall perimeter:

Wall Side	Length (ft) [Show calculations]
North	51 + 4 = 55
South	27 + 5 + 16 + 1 = 49
East	36 + 20 + 18 + 2 = 76
West	45 + 20 + 2 = 67
Total Wall Perimeter	247 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 (ft²) [Show calculations]
Wood No Storm Door	21 + 21 + 21 = 63
Total Door Area	63 ft²

3. Determine the Net Wall Area.

$$\text{Net Wall Area} = 247 \text{ ft} \times 10 \text{ ft} - 258 \text{ ft}^2 - 63 \text{ ft}^2$$
$$= 2149 \text{ ft}^2$$

4. Determine the Ceiling Area.

should be 2×39

Garage   Porch +

$$\text{Ceiling Area} = (58 \text{ ft} \times 67 \text{ ft}) - (18 \times 22) - (2 \times 33) - (1 \times 18) - (4 \times 36) - (16 \times 16)$$
$$-(3 \times 45)$$
$$= 3886 \text{ ft}^2 - 396 - 66 - 18 - 144 - 256 - 135$$
$$= 3886 \text{ ft}^2 - 1015 \text{ ft}^2$$
$$= 2871 \text{ ft}^2$$

Part 2: Heat Load (Heat Loss)

Item	Area (ft²)
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

ft² of Windows — Heat Gain

North (single)	x 26	=	
North (double) 84	x 21	=	1764
NE & NW (single)	x 45	=	
NE & NW (double)	x 35	=	
E & W (single)	x 60	=	
E & W (double) 134	x 49	=	6566
SE & SW (single)	x 50	=	
SE & SW (double)	x 40	=	
South (single)	x 36	=	
South (double) 40	x 25	=	1000

ft² of Doors — Heat Gain

Wood (no storm door) 63	x 13	=	819
Wood (w/storm door)	x 9	=	
Insulated Metal Door	x 6	=	

ft² of Net Walls — Heat Gain

Wall perimeter 247 x 10 Wall Height 2470 less 321 glass & door area = net wall area 2149 ft²

No insulation	x 8	=	
R-13 (3½") Insulation	x 3	=	
R-19 (6" Insulation) 2149	x 2	=	4298

ft² 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) 2871	x 1.6	=	4594

ft² of Floor — Heat Gain

No insulation	x 3	=	
Carpet No Insulation	x 2	=	
R-11 (3" Insulation)	x 1	=	
Floor on Slab 2871	x 0	=	0

Infiltration / Ventalation — Heat Gain

Home ft² 2871	x 3.5	=	10,049

Internal Gains — Heat Gain

Number of People 6	x530	=	3180
Kitchen & Bath Allowance			1250

Subtotal BTU/h heat gain = 33,520

Gains from Duct Work — Heat Gain

In crawl space - (subtotal BTU/h x .09)	=	
In atttic - (subtotal BTU/h x .13)	=	4358

Total BTU/h heat gain = 37,878

Heat Load (Heat Loss) - 0 Degree Day

ft² of Windows — Heat Loss

Single Glass	x 97	=	
Double Glass 178	x 69	=	12,282

ft² of Doors — Heat Loss

Single Glass Patio	x 99	=	
Double Glass Patio 80	x 72	=	5760
Wood No Storm Door 63	x 75	=	4725
Wood w/Storm Door	x 46	=	
Insulated Metal Door	x 35	=	

ft² of Net Walls — Heat Loss

Frame (no insulation)	x 20	=	
Frame (3½" insulation)	x 7	=	
Frame (6" insulation) 2149	x 5	=	10,745
Masonry (no insulation)	x 37	=	
Masonry (1" insulation)	x 11	=	

ft² of Ceiling — Heat Loss

No insulation	x 25	=	
R-11 (3") Insulation	x 7	=	
R-19 (6" Insulation)	x 4	=	
R-30 (10" Insulation) 2871	x 3	=	8613

ft² of Floor Over Crawl Space — Heat Loss

No insulation	x 19	=	
Carpet no Insulation	x 9	=	
R-11 (3+" Insulation)	x 6	=	

ft² 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) 247	x 22	=	5434

Infiltration / Ventilation — Heat Loss

Home ft² 2871	x 4.9	=	14,068

Subtotal BTU/h Heat Loss = 61,627

Losses From Ductwork — Heat Loss

In crawl space - (subtotal BTU/h x .10)	=	
In atttic - (subtotal BTU/h x .08)	=	4930

Total BTU/h Heat Loss = 66,557

80% Furnace Efficiency Loss	x 0.25	=	
90% Furnace Efficiency Loss	X 0.12	=	7987

Total BTU/h Heat input needed = 74,544