## ESSENTIAL MATH FORMULAS

### DESIRED BODY WEIGHT (DBW)

\[
DBW = \frac{LBW}{(1 - DBF\%)}
\]

**Step 1:** 100% - Fat % = Lean body %
**Step 2:** Body weight x Lean body % = LBW
**Step 3:** 100% - Desired fat % = Desired lean %
**Step 4:** LBW + Desired lean % = DBW

**Example:** 200-pound individual with 30% body fat; how much will he or she weigh at 25% body fat?
- 100% - 30% = 70%
- 200 pounds x 0.70 = 140 pounds LBW
- 100% - 25% = 75%
- 140 pounds ÷ 0.75 = 187 pounds DBW

### WAIST-TO-HIP RATIO (WHR)

\[
\text{Waist ÷ Hip} = \text{WHR}
\]

**Example:** Individual with 36-inch waist and 35-inch hip circumference
36 in ÷ 35 in = 1.03

### BMI METRIC FORMULA

\[
\text{Metric Formula: Weight (kg) ÷ Height}^2 \text{ (m)}
\]

**Weight conversion:**
weight in pounds ÷ 2.2 = weight in kg
**Height conversion:**
(height in inches x 2.54) ÷ 100 = height in meters

**Example:** BMI for a 5’8”, 196-pound individual
\[
\frac{(5' \times 12) + 8}{68'' \times 2.54} \div 100 = 1.73 \text{ m}
\]
89 kg ÷ (1.73 m x 1.73 m) = 30 (rounded up)

### BMI STANDARD FORMULA

\[
\left\lceil \frac{(\text{Weight (lbs)} \times 703) + \text{Height (inches)}}{\text{Height (inches)}} \right\rceil
\]

- Multiply weight (lbs) by 703
- Convert the height into inches: feet x 12 + inches
- Divide (weight x 703) twice by the height in inches

**Example:** BMI for a 5’8”, 196 pound individual
- 196 lbs x 703 = 137,788
- 137,788 ÷ 68 inches = 2026.3 (rounded up)
- 2026.3 ÷ 68 inches = 29.7 = 30 (rounded up)

### PREDICTED MAXIMAL HEART RATE

- Fox, Naughton, Haskell: MHR = 220 - Age
- Tanaka, Monahan, Seals: MHR = 208 - (0.7 x Age)
- Gellish et al.: MHR = 206.9 - (0.67 x Age)

**Example:** Calculate the maximum heart rate for a 42-year-old client
Fox, Naughton, Haskell: 220 - 42 = 178 bpm
Tanaka, Monahan, Seals: 208 - (0.7 x 42) = 179 bpm
Gellish et al.: 206.9 - (0.67 x 42) = 179 bpm

### KARVONEN FORMULA – HEART RATE RESERVE (HRR)

\[
\text{Target HR (THR)} = (\text{HRR} \times \% \text{ Intensity}) + \text{RHR}
\]

Where: HRR = MHR - RHR

**Example:** 34-year-old, resting heart rate = 62 bpm, 75% of HRR
Step 1: 220 - 34 = 186 bpm (max heart rate)
Step 2: 186 (Max HR) - 62 (resting HR) = 124 (HRR)
Step 3: 124 (HRR) X 0.75 (% HRR) + 62 (Resting HR) = 155 bpm (Target Heart Rate)

### CALORIC (KCAL) VALUES PER GRAM (G)

- Fat = 9 kcal/g
- Alcohol = 7 kcal/g
- Carbohydrates = 4 kcal/g
- Protein = 4 kcal/g

---

©2020 American Council on Exercise
**TOTAL CALORIES AND PERCENTAGE OF CALORIES**

Nutrition label values: 36g carbohydrate, 11g protein, 8g fat

Total Calories:
- Calories from carbs: $36g \times 4\text{cal/g} = 144$ calories
- Calories from protein: $11g \times 4\text{cal/g} = 44$ calories
- Calories from fat: $8g \times 9\text{cal/g} = 72$ calories

Total calories = $144 + 44 + 72 = 260$ calories

Percentage of Calories:
- Carb calories \div total calories = % of calories from carbohydrate $144 \div 260 = 55\%$ (0.55) of calories from carbohydrate
- Protein calories \div total calories = % of calories from protein $44 \div 260 = 17\%$ (0.169) of calories are from protein
- Fat calories \div total calories = % of calories from fat $72 \div 260 = 28\%$ (0.276) of calories are from fat

---

**DAILY CALORIC DEFICIT NEEDED TO ACHIEVE DESIRED WEIGHT LOSS IN SET TIMEFRAME**

1 pound body fat = 3,500 kcal

Step 1: $(\text{Desired Weight Loss (pounds)} \times 3,500 \text{ kcal/pounds}) \div \# \text{ Weeks} = \text{Weekly Caloric Deficit (kcal/week)}$

Step 2: $\text{Weekly Caloric Deficit (kcal/week)} \div 7 \text{ days/week} = \text{Daily Caloric Deficit}$

Example: Individual wants to lose 15 pounds in 20 weeks; What daily caloric deficit is required to reach this goal?
- $(15 \text{ pounds} \times 3,500 \text{ kcal/pounds}) \div 20 \text{ weeks} = 2,625 \text{ kcal/week}$
- $2,625 \text{ kcal/week} \div 7 \text{ days/week} = 375 \text{ kcal/day}$

---

For additional information and guidance on these formulas, you can refer to your textbook, online material, or videos on [www.acefitness.org/fitness-certifications/ace-answers/](http://www.acefitness.org/fitness-certifications/ace-answers/)