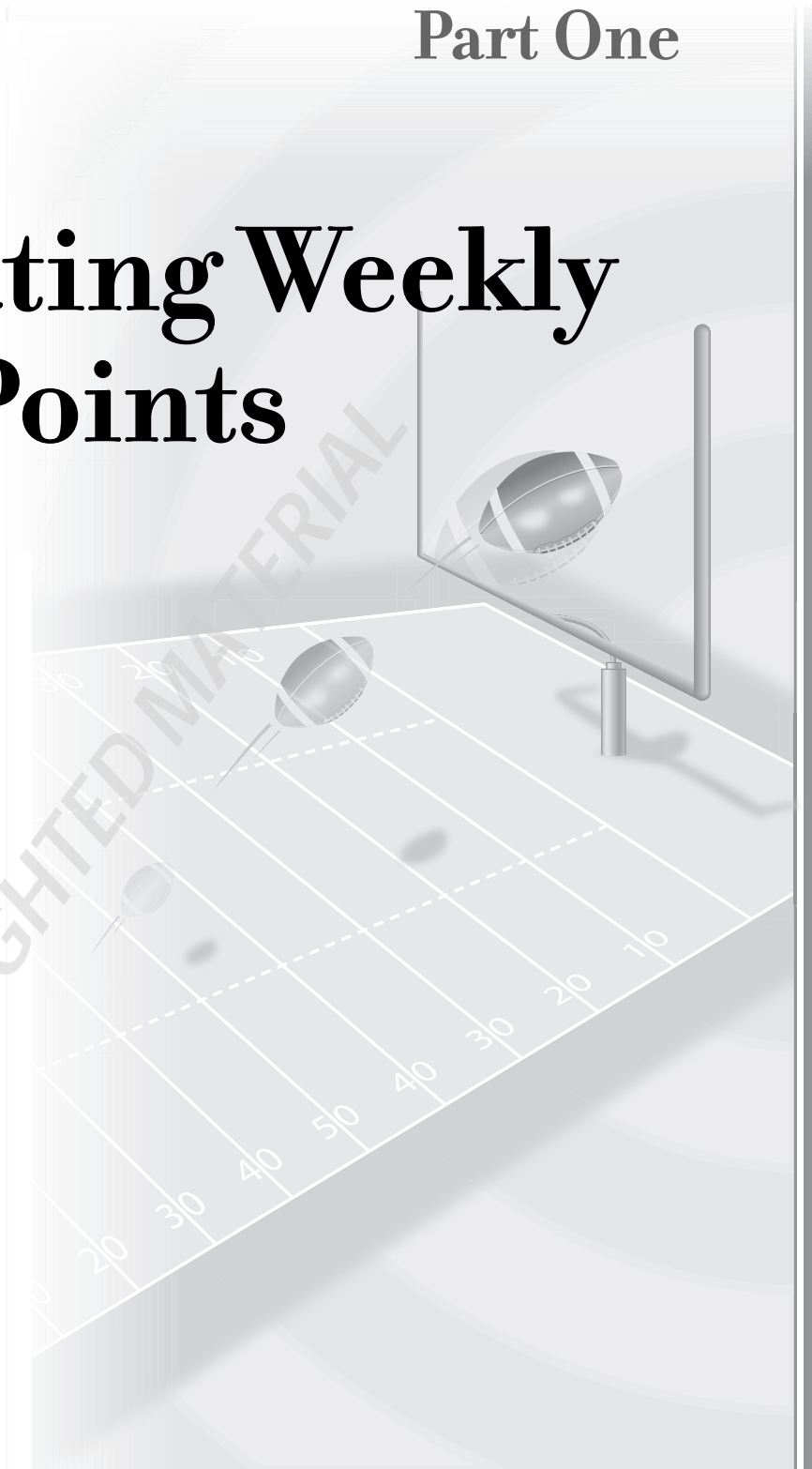


Part One

Computing Weekly Points

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Chapter One

How to Play Fantasy Football and Mathematics

Fantasy Football and Mathematics is a game in which participants create and manage their own teams of players from actual football teams. Students can select players or teams from professional, college, or high school, provided they have access to the players' or teams' statistics. The length of high school and college football seasons is shorter than professional football. Consequently, students should not combine players from professional, college, or high school football. In other words, participants' teams will consist of professional, college, or high school players or teams. Football players earn points by scoring touchdowns and two-point conversions as well as accumulating passing, rushing, and receiving yards. Players lose points for interceptions thrown and fumbles lost. Each week, students find the sum of the points earned by their players, using one of the scoring systems in this book. The object of the game is to accumulate the highest number of points.

How to Play the Game

Step 1: Selecting players.

Step 2: Reading box scores.

Step 3: Collecting data.

Step 4: Computing points.

Step 1: Selecting Players

There are two options for selecting players. Option 1 includes a salary cap and player values (that is, a cost associated for each player). Player values and salary caps will be updated before each season and posted at www.fantasysportsmath.com.

The process of creating new player values is time-consuming and requires research and an extensive knowledge of players' performance over the past several years. Additional factors taken into account when assigning player values include current injuries, if players recently changed teams, the strength of defensive units in a team's division, and others. The purchase of this book entitles you to one season of free player values. Lists of player values for subsequent seasons will be provided for a nominal fee. To access player values, visit www.fantasysportsmath.com. Click on "Player Values." Type in your password, which is w8c9e3c4. This password can be used one time only, after which time it will expire.

In option 2, you avoid the salary cap and player values, but students do not receive several benefits of these critical components of the game, which are explained later.

Option 1: Permanent Teams with Salary Cap

Students have \$40 million to spend on player values. Students select eleven players and two team defenses. Students may select the same players and team defenses. Table 1.1 lists the number of players selected at each position and the number in a starting lineup.

You can choose if students have to set their starting lineups before the weekend's games or if they can use the statistics from the best-performing players for that week. For example, a student could compute the points for both of her quarterbacks, then select the quarterback who generated the most points that week. I used the first method because it was less time consuming.

Table 1.1. Complete Roster and Starting Lineup Each Week

Position	Number of Players Selected for Position	Number of Players Selected for Starting Lineup
Quarterback	2	1
Running back	3	2
Wide receiver (includes tight ends)	4	3
Kicker	2	1
Team defense	2	1

The main advantage of using option 1 is that it promotes equality in the game. If students spend close to their complete salary cap, the quality of the teams should be relatively equal within the class. I had many students (both girls and boys) who knew very little about football yet managed to do very well; several even won the game. Another advantage of this option is that students have to compromise as they select players because the salary cap is structured so that they cannot simply select the top players at each position. This allows them to hone their decision-making skills, which facilitates their cognitive development. Students can also make trades.

Another benefit of using option 1 is that students get to work with large numbers as they attempt to spend as close as possible to the salary cap. Moreover, in addition to circle graphs, students will construct stacked-bar and multi-line graphs to track player performance over time because they will use the same players for the duration of the game.

Finally, in option 1, if a player is determined to be out for the year, students can use the portion of the salary cap they spent on that player to purchase another player.

For all of these reasons, option 1 is recommended.

Option 2: Different Teams Each Week

Each week, students select one team. For example, a student who lives in Atlanta may decide to select her hometown team for the first week of the game. However, she will not be allowed to choose that team in later weeks because each student can select the same team only once during the game. Two or more students can select the same team in a given week. Unlike in option 1, points are earned in this option from team statistics rather than from the statistics of individual players. For example, if a team had a total of 127 yards rushing, that is the number the student would use to compute points.

In this option, it is important for students to select high-scoring teams playing against weak opponents in order to maximize the points they earn. That said, there is as much luck involved in Fantasy Football as there is skill.

If you use option 1 to select players, students' rosters will remain the same for the duration of the game (with the exception of trades, which are explained later in the chapter). If you use option 2, students' players will change every week. *Note that the handouts, graphs, and worksheets in this book are based on option 1.*

Choosing Your Own Team

Like your students, you too should create your own fantasy team. You can use your team as an example and to help assess students' work. Students also enjoy competing with their teachers or parents!

Trades

Students may trade players if they are using option 1. In this situation, salary cap numbers do not apply. When a trade is consummated, the students making that trade must alter their fantasy team roster.

Trades do not have to be position for position. For example, a student might trade a kicker for a quarterback. But in that case, the student would have only one kicker. If that player was injured, the student would be left in a difficult position, without a kicker in his or her starting lineup. Students therefore need to be aware of the impact of trades on their full rosters.

Based on my experience with this game, you may want to limit the number of trades to five or ten per student. Otherwise, some students may make so many trades they cannot remember who is on their team.

Injuries and Bye Weeks

If you cannot locate a player's name in the box scores, he is probably injured or the teams didn't play that week (this is called a *bye week*). *If this occurs, the players' score is counted as zero.* A player who is placed on injured reserve (IR) will not play for the remainder of the season. If a player is declared out for the year and students are using option 1, a student who had selected that player can use the portion of the salary cap spent on that player to purchase another player. A list of injured players can be found in newspapers as well as online at fantasysportsmath.com or other sports Web sites.

Step 2: Reading Box Scores

Box scores are written in several formats. The sections of box scores you will use are usually titled "Scoring Summary" and "Player (or Individual) Statistics." A player (other than a kicker) whose name is listed in the scoring summary has scored a touchdown or passed for a touchdown. (The only exception is a two-point conversion, which occurs when a team elects to try for two points rather than kick the point after a touchdown. On a two-point conversion, a team gets one chance to get the ball in the end zone from the two-yard line.)

Table 1.2 shows one section of a fabricated box score. You will see that the first score of the game was a three-yard touchdown run by Aaron Dunlap. Additional touchdowns were scored in the second quarter by Frank Loery, Devan Shalter, Gary Hollings, and Ollie Mays. In addition, Steve Blake and Jesse Wade passed for touchdowns in the second quarter.

Kickers earn points for field goals (FG) and the point after touchdown (PAT). Notice, for example, that Angel Ramos kicked the point after touchdown after the first touchdown of the game. He also kicked a field goal in the first quarter.

The touchdowns scored by Devan Shalter and Gary Hollings were scored by players on defensive teams. Therefore, students who had the Panthers or Tigers as their defensive team would earn points. Defensive touchdowns are preceded by phrases such as "interception return," "fumble return," "punt return," "kick-off return," or "fumble recovery in end zone." Defensive teams also earn points for safeties, which occur when an offensive player is tackled in his own end zone. Safeties are listed as such and are rare; there were not any safeties in this game.

Table 1.2. Sample Box Score: Panthers at Tigers

1ST QUARTER

TD Aaron Dunlap, 3 Yd run (Angel Ramos kick is good), 9:59. Drive: 9 plays, 63 yards in 5:01.

FG Angel Ramos 38 Yd, 2:00. Drive: 8 plays, 76 yards in 4:31.

2ND QUARTER

TD Frank Loery, 8 Yd pass from Steve Blake (Angel Ramos kick is good), 13:43. Drive: 6 plays, 27 yards in 3:08.

TD Devan Shalter, 40 Yd interception return (Henry Darris 2 Pt. Conversion pass to failed), 4:41.

TD Gary Hollings, 96 Yd kick return (Angel Ramos kick is good), 4:27.

TD Ollie Mays, 7 Yd pass from Jesse Wade (Brian Martinez kick is good), 1:14. Drive: 5 plays, 50 yards in 1:26.

3RD QUARTER

FG Brian Martinez 44 Yd, 12:14. Drive: 8 plays, 26 yards in 2:46.

TD Mack Knightly, 3 Yd pass from Jesse Wade (Jesse Wade pass to Ty Johnson for 2 Pt. Conversion), 1:54. Drive: 4 plays, 60 yards in 1:41.

4TH QUARTER

FG Brian Martinez 37 Yd, 11:38. Drive: 9 plays, 71 yards in 3:49.

TD D. J. Tucker, 1 Yd pass from Jesse Wade (Brian Martinez kick is good), 8:57. Drive: 6 plays, 25 yards in 2:33.

FG Brian Martinez 26 Yd, 3:22. Drive: 9 plays, 33 yards in 3:48.

TD Gary Hollings, 15 Yd pass from Steve Blake (Angel Ramos kick is good), 1:24. Drive: 8 plays, 75 yards in 1:58.

Note: TD = touchdown. FG = field goal.

Players lose points for interceptions thrown and fumbles lost. The box score in Table 1.3 shows that Jesse Wade threw one interception (INT), and Gary Hollings and Josh Maris each lost one fumble.

The starting lineup in Table 1.4 is used for reference purposes throughout this book.

Step 3: Collecting Data

Each week, students use newspapers or online resources to access data from one game in which each of the players in their starting lineup participated. There are several options for collecting data:

1. Enroll your class in a newspapers-in-education program in order to receive free copies of newspapers.
2. If it is not possible to enroll in a newspapers-in-education program, choose a couple of students to cut box scores out of a newspaper and make copies for the other students. Students can reference the football standings in the newspaper to ensure that they have cut out a box score for each team that played that week.

3. Have students go to www.fantasysportsmath.com and do the following:
 - a. Click the "Get Football Stats" link.
 - b. On the following page, use the calendar to select the week you are looking for.
 - c. Find a team one of your players participated in and click on the box score for that game.

Using online resources is the quickest and easiest method. Statistics are also archived online so that students can access data in case they missed a week or two.

Table 1.3. Box Score: Panthers at Tigers (Week 1)

PASSING—Panthers				
	CP/AT	YDS	TD	INT
J. Wade	33/48	369	3	1
PASSING—Tigers				
	CP/AT	YDS	TD	INT
S. Blake	19/30	221	2	2
RUSHING—Panthers				
	ATT	YDS	TD	LG
T. Johnson	9	15	0	7
L. Jones	4	14	0	8
J. Wade	4	−1	0	2
RUSHING—Tigers				
	ATT	YDS	TD	LG
A. Dunlap	18	84	1	16
J. Maris	7	34	0	21
Y. Ussif	1	23	0	23
S. Blake	1	3	0	3
RECEIVING—Panthers				
	REC	YDS	TD	LG
O. Mays	11	171	1	30
D. J. Tucker	9	67	1	19
T. Johnson	6	33	0	11
M. Knightly	7	98	1	31

(Cont'd.)

Table 1.3. Box Score: Panthers at Tigers (Week 1) (Cont'd.)

RECEIVING—Tigers				
	REC	YDS	TD	LG
F. Loery	7	109	1	49
G. Hollings	4	45	1	22
M. Sallinger	1	38	0	38
Y. Ussif	5	24	0	10
T. Faumuina	2	5	0	4
FUMBLES—Panthers				
	FUM	LOST	REC	YDS
C. Vickman	1	1	0	0
FUMBLES—Tigers				
	FUM	LOST	REC	YDS
G. Hollings	1	1	0	0
J. Maris	1	1	0	0
KICKING—Panthers				
	FG	LG	XP	PTS
B. Martinez	3/4	44	2/2	11
KICKING—Tigers				
	FG	LG	XP	PTS
A. Ramos	1/1	38	4/4	7

Note: cp = number of completed passes; at = number of passes attempted; yds = number of yards gained; td = number of touchdowns; int = number of interceptions; att = number of rushing attempts; lg = longest(gain); rec = number of receptions; fum = number of fumbles; lost = number of fumbles lost; rec = number of fumbles recovered; fg = field goal; lg = longest(field goal); xp = number of extra points(or PATs); pts = number of points scored

Table 1.4. Starting Lineup for the Wildcats

Jesse Wade	Quarterback
Ty Johnson	Running back
Josh Maris	Running back
Ollie Mays	Wide receiver
D. J. Tucker	Wide receiver
Tao Faumuina	Wide receiver
Angel Ramos	Kicker
Tigers	Defense

Step 4: Computing Points

The default scoring system (see Table 1.5) can be used each week to determine the ranking of students' teams in the game. The default scoring system was designed so that students can plot the weekly points earned for their players to precise numerical values on stacked-bar and multiple-line graphs. This is explained later. However, if you wish, you may choose a different scoring system to meet your students' skill level. The default scoring system is one of 111 included in this book. Scoring systems are dynamic because they give students opportunities to work with roots, exponents, summations, factorials, integers, fractions, decimals, and absolute value.

The default scoring system is dynamic because it uses all factors of 48—for example, two touchdowns equal one-fourth, and one touchdown and one two-point conversion equal one-sixth.

Table 1.5. Default Scoring System

For Each:	Players Earn:		
Kickers			
Point after touchdown (PAT)	$\frac{1}{48}$	or	.021
Field goal (FG)	$\frac{1}{16}$	or	.063
Quarterbacks, running backs, wide receivers, defenses			
Touchdown (by passing, rushing, or receiving)	$\frac{1}{8}$	or	.125
Two point conversion	$\frac{1}{24}$	or	.042
Touchdown by a defense	$\frac{1}{8}$	or	.125
Safety by a defense	$\frac{1}{24}$	or	.042
Interception	$-\frac{1}{12}$	or	-.083
Fumble	$-\frac{1}{16}$	or	-.063
Passing yards	$\frac{1}{48}$	for every 25 yards	
Rushing or receiving yards	$\frac{1}{48}$	for every 10 yards	

Note: Decimals are rounded to the nearest thousandth.

The points that players earn can be computed using two different methods. One method uses algebra, and the other does not. If students use both methods to compute points, they can verify their results. If they do not have the skills to work with variables in linear equations, they can use the non-algebraic method to compute points.

Non-Algebraic Method

The non-algebraic method lists touchdowns, two-point conversions, and yards gained for each player. Points are earned for each set of 25 yards gained from passing, as well as each set of 10 yards gained from rushing or receiving. Consequently, yards gained from passing are divided by 25, and yards gained from rushing or receiving are divided by 10. Quotients are always rounded down to the nearest whole number. For example, Jesse Wade passed for 369 yards, which is divided by 25. The quotient of 14.76 is rounded down to 14. Since there are 14 25s in 369 and each 25 yards is worth $\frac{1}{48}$, 14 is multiplied by $\frac{1}{48}$ to arrive at $\frac{14}{48}$. This process is also used to compute points earned from rushing and receiving yards, with the exception that students compute the number of 10s rather than the number of 25s.

Table 1.6 uses the non-algebraic method to compute the points for the Wildcats. I recommend using this method for the first few weeks before introducing students to the second method.

Algebraic Method

The second method of computing points is algebraic; it uses linear equations that contain variables. These equations are known as *total points equations* because they are used to compute the total points for one week for all players, with the exception of kickers and team defenses. Younger students may be initially intimidated by the algebraic look of the equations. However, once they have used them a few times, they become comfortable and feel proud that they are doing algebra.

Default Total Points Equation for Quarterbacks, Running Backs, and Wide Receivers

The default total points equation (the algebraic method) and the default scoring system (the non-algebraic method) contain the same numerical values. Consequently, students can check their work if they use both methods because both methods will result in the same answer.

$$\frac{1}{8} (T) + \frac{1}{24} (V) + \frac{1}{48} (P + R + C) - \frac{1}{12} (I) - \frac{1}{16} (F) = W$$

T = number of touchdowns scored by passing, rushing, or receiving

V = number of two-point conversions scored by passing, rushing, or receiving

P = number of passing yards divided by 25, then rounded down to the nearest whole number

Table 1.6. Points Earned by the Wildcats: Non-Algebraic Method

	Wade	Johnson	Maris	Mays	Tucker	Faumuina	Ramos	Tigers
Number of TDs $\times \frac{1}{8}$	$\frac{3}{8}$	0	0	$\frac{1}{8}$	$\frac{1}{8}$	0	0	$\frac{1}{8}$
Number of 2-point conversions or safeties $\times \frac{1}{24}$	$\frac{1}{24}$	$\frac{1}{24}$	0	0	0	0	0	0
Number of passing yards (in 25s) $\times \frac{1}{48}$	$\frac{14}{48}$	0	0	0	0	0	0	0
Number of rushing yards (in 10s) $\times \frac{1}{48}$	0	$\frac{1}{48}$	$\frac{3}{48}$	0	0	0	0	0
Number of receiving yards (in 10s) $\times \frac{1}{48}$	0	$\frac{3}{48}$	0	$\frac{17}{48}$	$\frac{6}{48}$	0	0	0
Number of PATs $\times \frac{1}{48}$	0	0	0	0	0	0	$\frac{4}{48}$	0
Number of FGs $\times \frac{1}{16}$	0	0	0	0	0	0	$\frac{1}{16}$	0
Number of interceptions $\times \left(-\frac{1}{12}\right)$	$-\frac{1}{12}$	0	0	0	0	0	0	0
Number of fumbles lost $\times \left(-\frac{1}{16}\right)$	0	0	$-\frac{1}{16}$	0	0	0	0	0
Total individual points:	$\frac{30}{48}$	$\frac{6}{48}$	0	$\frac{23}{48}$	$\frac{12}{48}$	0	$\frac{7}{48}$	$\frac{1}{8}$
Total team points: $\frac{30}{48} + \frac{6}{48} + \frac{23}{48} + \frac{12}{48} + \frac{7}{48} + \frac{1}{8} = \frac{84}{48} = 1\frac{36}{48} = 1\frac{3}{4}$								

R = number of rushing yards divided by 10, then rounded down to the nearest whole number

C = number of receiving yards divided by 10, then rounded down to the nearest whole number

I = number of interceptions thrown

F = number of fumbles lost

W = total points scored for one week for one individual player

Example Using Default Total Points Equation:

Points Earned for the Wildcats

Jesse Wade

$$\frac{1}{8} (3) + \frac{1}{24} (1) + \frac{1}{48} (14 + 0 + 0) - \frac{1}{12} (1) - \frac{1}{16} (0) = \frac{5}{8}$$

Ty Johnson

$$\frac{1}{8} (0) + \frac{1}{24} (1) + \frac{1}{48} (0 + 1 + 3) - \frac{1}{12} (0) - \frac{1}{16} (0) = \frac{1}{8}$$

Josh Maris

$$\frac{1}{8} (0) + \frac{1}{24} (0) + \frac{1}{48} (0 + 3 + 0) - \frac{1}{12} (0) - \frac{1}{16} (1) = 0$$

Ollie Mays

$$\frac{1}{8} (1) + \frac{1}{24} (0) + \frac{1}{48} (0 + 0 + 17) - \frac{1}{12} (0) - \frac{1}{16} (0) = \frac{23}{48}$$

D. J. Tucker

$$\frac{1}{8} (1) + \frac{1}{24} (0) + \frac{1}{48} (0 + 0 + 6) - \frac{1}{12} (0) - \frac{1}{16} (0) = \frac{1}{4}$$

Tao Faumuina

$$\frac{1}{8} (0) + \frac{1}{24} (0) + \frac{1}{48} (0 + 0 + 0) - \frac{1}{12} (0) - \frac{1}{16} (0) = 0$$

Angel Ramos

$$4 \text{ PATs} \left(4 \cdot \frac{1}{48} \right) + 1 \text{ FG} \left(\frac{1}{16} \right) = \frac{7}{48}$$

Tigers Defense

$$1 \text{ touchdown} = \frac{1}{8}$$

$$\text{Total points for the Wildcats} \frac{84}{48} = 1\frac{36}{48} = 1\frac{3}{4} \text{ or } 1.75$$

Additional Scoring Systems

The following pages list 111 scoring systems. Choose a system that is appropriate for the skill level of your students. If students are not prepared to use variables in linear equations, you can still use any scoring system by simply using the values from any total points equation. Let's say that for a few weeks, you use the default scoring system, which is based on a common denominator of 48. If you want students to practice with a different common denominator

(or practice with decimals, exponents, roots, or something else), you could use numerical values from a different equation. Students should use the same scoring system throughout the game in order to determine their cumulative points so they can update their stacked-bar and multiple-line graphs. Introduce new scoring systems when your students are ready.

Scoring systems are categorized according to their content and whether they contain relative proportionality. For example, scoring systems number six and ten (located below) use relative proportionality because the ratios between the fractions in each equation are the same. In other words, a touchdown is worth twice as much as a field goal, three times as much as a safety, and six times as much as an extra point.

$$6. \quad \frac{1}{2} (T) + \frac{1}{6} (V) + \frac{1}{12} (P + R + C) - \frac{1}{3} (I) - \frac{1}{4} (F) = W$$

$$FG = \frac{1}{4} \quad PAT = \frac{1}{12} \quad Safety = \frac{1}{6}$$

$$10. \quad \frac{1}{4} (T) + \frac{1}{12} (V) + \frac{1}{24} (P + R + C) - \frac{1}{6} (I) - \frac{1}{8} (F) = W$$

$$FG = \frac{1}{8} \quad PAT = \frac{1}{24} \quad Safety = \frac{1}{12}$$

The advantage of scoring systems that use relative proportionality is that you can use these different scoring systems during the course of the game without unfairly changing the rankings. In other words, a student whose team earned the highest number of points in a given week will earn the highest number of points in that week no matter which scoring systems are used, as long as the scoring systems are proportionate. Conversely, let's say you used a scoring system that was based on fractions for the first ten weeks, then used a different scoring system for week 11 that was based on factorials and not proportionate to the original scoring system you used. It is possible that the student who was in last place after ten weeks could leap into first place after week 11 if her team performed strongly, because the scoring systems based on factorials are not proportionate and can result in teams earning hundreds of points in one week. Consequently, it's not fair for a student who has built up a small lead over the course of ten weeks to suddenly be hundreds of points out of the lead based on the results of one week. For this reason, I suggest using the same scoring system or scoring systems that are proportionate throughout the game in order to determine standings. If you wish to include other scoring systems, I would not include these to determine the rankings of the students' teams. Scoring systems 4 to 25 and 29 to 70 contain relative proportionality.

Many scoring systems (that is, total points equations) are more advanced than the default scoring system, especially those that are based on negative numerical values. In such cases, the goal is to acquire the fewest points (or the greatest absolute value). Acquiring the fewest points is an effective way to teach the concept of absolute value. In the following example, a player might earn $\frac{7}{48}$ if a student used scoring system number four. However, if the student placed

absolute value symbols around scoring system number five before using it to compute points, the player would also earn $\frac{7}{48}$.

$$4. \frac{1}{8} (2) + \frac{1}{24} (0) + \frac{1}{48} (9 + 1 + 0) - \frac{1}{12} (3) - \frac{1}{16} (1) = \frac{7}{48}$$

$$5. \left| -\frac{1}{8} (2) - \frac{1}{24} (0) - \frac{1}{48} (9 + 1 + 0) + \frac{1}{12} (3) + \frac{1}{16} (1) \right| = \frac{7}{48}$$

Consequently, students can check their work by computing points earned using both positive and negative versions of the same scoring system since both answers will result in the same absolute value. In order to do this, you may simply insert absolute value symbols around any equation that is based on negative numerical values.

It is possible (although unlikely) for a player to earn a negative number of points even if students are using equations based on positive numerical values. In other words, a player may have a bad game statistically and not generate enough positive points to offset the negative points earned by his interceptions or fumbles. You can prevent this situation by using equation 2 below or by informing students that the lowest score for one week will be zero, thus ensuring that younger students will not be confused by negative numerical values.

Total Points Equations

Integers

$$1. 6 (T) + 2 (V) + 3 (P + R + C) - 1(I) - 1(F) = W$$

$$\text{FG} = 3 \quad \text{PAT} = 1 \quad \text{Safety} = 2$$

$$2. 6 (T) + 2 (V) + 1 (P + R + C) = W$$

$$\text{FG} = 3 \quad \text{PAT} = 1 \quad \text{Safety} = 2$$

$$3. -6 (T) - 2 (V) - 1(P + R + C) + 4(I) + 3(F) = W$$

$$\text{FG} = 3 \quad \text{PAT} = 1 \quad \text{Safety} = 2$$

Fractions

$$4. \frac{1}{8} (T) + \frac{1}{24} (V) + \frac{1}{48} (P + R + C) - \frac{1}{12} (I) - \frac{1}{16} (F) = W$$

$$\text{FG} = \frac{1}{16} \quad \text{PAT} = \frac{1}{48} \quad \text{Safety} = \frac{1}{24}$$

$$5. -\frac{1}{8} (T) - \frac{1}{24} (V) - \frac{1}{48} (P + R + C) + \frac{1}{12} (I) + \frac{1}{16} (F) = W$$

$$\text{FG} = -\frac{1}{16} \quad \text{PAT} = -\frac{1}{48} \quad \text{Safety} = -\frac{1}{24}$$

$$6. \frac{1}{2} (T) + \frac{1}{6} (V) + \frac{1}{12} (P + R + C) - \frac{1}{3} (I) - \frac{1}{4} (F) = W$$

$$\text{FG} = \frac{1}{4} \quad \text{PAT} = \frac{1}{12} \quad \text{Safety} = \frac{1}{6}$$

$$7. -\frac{1}{2}(T) - \frac{1}{6}(V) - \frac{1}{12}(P + R + C) + \frac{1}{3}(I) + \frac{1}{4}(F) = W$$

$$FG = -\frac{1}{4} \quad PAT = -\frac{1}{12} \quad \text{Safety} = -\frac{1}{6}$$

$$8. \frac{1}{3}(T) + \frac{1}{9}(V) + \frac{1}{18}(P + R + C) - \frac{1}{4.5}(I) - \frac{1}{6}(F) = W$$

$$FG = \frac{1}{6} \quad PAT = \frac{1}{18} \quad \text{Safety} = \frac{1}{9}$$

$$9. -\frac{1}{3}(T) - \frac{1}{9}(V) - \frac{1}{18}(P + R + C) + \frac{1}{4.5}(I) + \frac{1}{6}(F) = W$$

$$FG = -\frac{1}{6} \quad PAT = -\frac{1}{18} \quad \text{Safety} = -\frac{1}{9}$$

$$10. \frac{1}{4}(T) + \frac{1}{12}(V) + \frac{1}{24}(P + R + C) - \frac{1}{6}(I) - \frac{1}{8}(F) = W$$

$$FG = \frac{1}{8} \quad PAT = \frac{1}{24} \quad \text{Safety} = \frac{1}{12}$$

$$11. -\frac{1}{4}(T) - \frac{1}{12}(V) - \frac{1}{24}(P + R + C) + \frac{1}{6}(I) + \frac{1}{8}(F) = W$$

$$FG = -\frac{1}{8} \quad PAT = -\frac{1}{24} \quad \text{Safety} = -\frac{1}{12}$$

$$12. \frac{1}{5}(T) + \frac{1}{15}(V) + \frac{1}{30}(P + R + C) - \frac{1}{7.5}(I) - \frac{1}{10}(F) = W$$

$$FG = \frac{1}{10} \quad PAT = \frac{1}{30} \quad \text{Safety} = \frac{1}{15}$$

$$13. -\frac{1}{5}(T) - \frac{1}{15}(V) - \frac{1}{30}(P + R + C) + \frac{1}{7.5}(I) + \frac{1}{10}(F) = W$$

$$FG = -\frac{1}{10} \quad PAT = -\frac{1}{30} \quad \text{Safety} = -\frac{1}{15}$$

$$14. \frac{1}{6}(T) + \frac{1}{18}(V) + \frac{1}{36}(P + R + C) - \frac{1}{9}(I) - \frac{1}{12}(F) = W$$

$$FG = \frac{1}{12} \quad PAT = \frac{1}{36} \quad \text{Safety} = \frac{1}{18}$$

$$15. -\frac{1}{6}(T) - \frac{1}{18}(V) - \frac{1}{36}(P + R + C) + \frac{1}{9}(I) + \frac{1}{12}(F) = W$$

$$FG = -\frac{1}{12} \quad PAT = -\frac{1}{36} \quad \text{Safety} = -\frac{1}{18}$$

$$16. \frac{1}{7}(T) + \frac{1}{21}(V) + \frac{1}{42}(P + R + C) - \frac{1}{10.5}(I) - \frac{1}{14}(F) = W$$

$$FG = \frac{1}{14} \quad PAT = \frac{1}{42} \quad \text{Safety} = \frac{1}{21}$$

$$17. -\frac{1}{7}(T) - \frac{1}{21}(V) - \frac{1}{42}(P + R + C) + \frac{1}{10.5}(I) + \frac{1}{14}(F) = W$$

$$FG = -\frac{1}{14} \quad PAT = -\frac{1}{42} \quad \text{Safety} = -\frac{1}{21}$$

18. $\frac{1}{9}(T) + \frac{1}{27}(V) + \frac{1}{54}(P + R + C) - \frac{1}{13.5}(I) - \frac{1}{18}(F) = W$
 $FG = \frac{1}{18} \quad PAT = \frac{1}{54} \quad Safety = \frac{1}{27}$
19. $-\frac{1}{9}(T) - \frac{1}{27}(V) - \frac{1}{54}(P + R + C) + \frac{1}{13.5}(I) + \frac{1}{18}(F) = W$
 $FG = -\frac{1}{18} \quad PAT = -\frac{1}{54} \quad Safety = -\frac{1}{27}$
20. $\frac{1}{10}(T) + \frac{1}{30}(V) + \frac{1}{60}(P + R + C) - \frac{1}{15}(I) - \frac{1}{20}(F) = W$
 $FG = \frac{1}{20} \quad PAT = \frac{1}{60} \quad Safety = \frac{1}{30}$
21. $-\frac{1}{10}(T) - \frac{1}{30}(V) - \frac{1}{60}(P + R + C) + \frac{1}{15}(I) + \frac{1}{20}(F) = W$
 $FG = -\frac{1}{20} \quad PAT = -\frac{1}{60} \quad Safety = -\frac{1}{30}$
22. $\frac{1}{25}(T) + \frac{1}{75}(V) + \frac{1}{150}(P + R + C) - \frac{1}{37.5}(I) - \frac{1}{50}(F) = W$
 $FG = \frac{1}{50} \quad PAT = \frac{1}{150} \quad Safety = \frac{1}{75}$
23. $-\frac{1}{25}(T) - \frac{1}{75}(V) - \frac{1}{150}(P + R + C) + \frac{1}{37.5}(I) + \frac{1}{50}(F) = W$
 $FG = -\frac{1}{50} \quad PAT = -\frac{1}{150} \quad Safety = -\frac{1}{75}$
24. $\frac{1}{100}(T) + \frac{1}{300}(V) + \frac{1}{600}(P + R + C) - \frac{1}{150}(I) - \frac{1}{200}(F) = W$
 $FG = \frac{1}{200} \quad PAT = \frac{1}{600} \quad Safety = \frac{1}{300}$
25. $-\frac{1}{100}(T) - \frac{1}{300}(V) - \frac{1}{600}(P + R + C) + \frac{1}{150}(I) + \frac{1}{200}(F) = W$
 $FG = -\frac{1}{200} \quad PAT = -\frac{1}{600} \quad Safety = -\frac{1}{300}$
26. $\frac{5}{6}(T) + \frac{4}{5}(V) + \frac{3}{4}(P + R + C) - \frac{2}{7}(I) - \frac{2}{8}(F) = W$
 $FG = \frac{2}{8} \quad PAT = \frac{3}{4} \quad Safety = \frac{4}{5}$
27. $\frac{1}{2}(T) + \frac{1}{3}(V) + \frac{1}{4}(P + R + C) - \frac{1}{5}(I) - \frac{1}{6}(F) = W$
 $FG = \frac{1}{6} \quad PAT = \frac{1}{4} \quad Safety = \frac{1}{3}$
28. $\frac{1}{2}(T) + \frac{1}{4}(V) + \frac{1}{8}(P + R + C) - \frac{1}{16}(I) - \frac{1}{32}(F) = W$
 $FG = \frac{1}{32} \quad PAT = \frac{1}{8} \quad Safety = \frac{1}{4}$

Decimals

29. $.006 (T) + .002 (V) + .001 (P + R + C) - .004 (I) - .003 (F) = W$
FG = .003 PAT = .001 Safety = .002
30. $-.006 (T) - .002 (V) - .001 (P + R + C) + .004 (I) + .003 (F) = W$
FG = $-.003$ PAT = $-.001$ Safety = $-.002$
31. $.075 (T) + .025 (V) + .0125 (P + R + C) - .05 (I) - .0375 (F) = W$
FG = .0375 PAT = .0125 Safety = .025
32. $-.075 (T) - .025 (V) - .0125 (P + R + C) + .05 (I) + .0375 (F) = W$
FG = $-.0375$ PAT = $-.0125$ Safety = $-.025$
33. $.06 (T) + .02 (V) + .01 (P + R + C) - .04 (I) - .03 (F) = W$
FG = .03 PAT = .01 Safety = .02
34. $-.06 (T) - .02 (V) - .01 (P + R + C) + .04 (I) + .03 (F) = W$
FG = $-.03$ PAT = $-.01$ Safety = $-.02$
35. $.1 (T) + .0\bar{3} (V) + .01\bar{6} (P + R + C) - .0\bar{6} (I) - .05 (F) = W$
FG = .05 PAT = $.01\bar{6}$ Safety = $.0\bar{3}$
36. $-.1 (T) - .0\bar{3} (V) - .01\bar{6} (P + R + C) + .0\bar{6} (I) + .05 (F) = W$
FG = $-.05$ PAT = $-.01\bar{6}$ Safety = $-.0\bar{3}$
37. $.1 (T) + .05 (V) + .025 (P + R + C) - .1 (I) - .075 (F) = W$
FG = .075 PAT = .025 Safety = .05
38. $-.15 (T) - .05 (V) - .025 (P + R + C) + .1 (I) + .075 (F) = W$
FG = $-.075$ PAT = $-.025$ Safety = $-.05$
39. $.3 (T) + .1 (V) + .05 (P + R + C) - .2 (I) - .15 (F) = W$
FG = .15 PAT = .05 Safety = .1
40. $-.3 (T) - .1 (V) - .05 (P + R + C) + .2 (I) + .15 (F) = W$
FG = $-.15$ PAT = $-.05$ Safety = $-.1$
41. $.6 (T) + .2 (V) + .1 (P + R + C) - .4 (I) - .3 (F) = W$
FG = .3 PAT = .1 Safety = .2
42. $-.6 (T) - .2 (V) - .1 (P + R + C) + .4 (I) + .3 (F) = W$
FG = $-.3$ PAT = $-.1$ Safety = $-.2$
43. $.9 (T) + .3 (V) + .15 (P + R + C) - .6 (I) - .45 (F) = W$
FG = .45 PAT = .15 Safety = .3
44. $-.9 (T) - .3 (V) - .15 (P + R + C) + .6 (I) + .45 (F) = W$
FG = $-.45$ PAT = $-.15$ Safety = $-.3$

Fractions and Decimals

45. $.25 (T) + \frac{1}{12} (V) + \frac{1}{24} (P + R + C) - \frac{1}{6} (I) - .125 (F) = W$
FG = .125 PAT = $\frac{1}{24}$ Safety = $\frac{1}{12}$

$$46. \quad -.25 (T) - \frac{1}{12} (V) - \frac{1}{24} (P + R + C) + \frac{1}{6} (I) + .125 (F) = W$$

$$FG = -.125 \quad PAT = -\frac{1}{24} \quad \text{Safety} = -\frac{1}{12}$$

$$47. \quad .2 (T) + \frac{1}{15} (V) + \frac{1}{30} (P + R + C) - \frac{1}{7.5} (I) - .1 (F) = W$$

$$FG = .1 \quad PAT = \frac{1}{30} \quad \text{Safety} = \frac{1}{15}$$

$$48. \quad -.2 (T) - \frac{1}{15} (V) - \frac{1}{30} (P + R + C) + \frac{1}{7.5} (I) + .1 (F) = W$$

$$FG = -.1 \quad PAT = -\frac{1}{30} \quad \text{Safety} = -\frac{1}{15}$$

$$49. \quad .1 (T) + \frac{1}{30} (V) + \frac{1}{60} (P + R + C) - \frac{1}{15} (I) - .5 (F) = W$$

$$FG = .5 \quad PAT = \frac{1}{60} \quad \text{Safety} = \frac{1}{30}$$

$$50. \quad -.1 (T) - \frac{1}{30} (V) - \frac{1}{60} (P + R + C) + \frac{1}{15} (I) + .5 (F) = W$$

$$FG = -.5 \quad PAT = -\frac{1}{60} \quad \text{Safety} = -\frac{1}{30}$$

$$51. \quad .04 (T) + \frac{1}{75} (V) + \frac{1}{150} (P + R + C) - \frac{1}{37.5} (I) - .02 (F) = W$$

$$FG = .02 \quad PAT = \frac{1}{150} \quad \text{Safety} = \frac{1}{75}$$

$$52. \quad -.04 (T) - \frac{1}{75} (V) - \frac{1}{150} (P + R + C) + \frac{1}{37.5} (I) + .02 (F) = W$$

$$FG = -.02 \quad PAT = -\frac{1}{150} \quad \text{Safety} = -\frac{1}{75}$$

$$53. \quad .01(T) + \frac{1}{300} (V) + \frac{1}{600} (P + R + C) - \frac{1}{150} (I) - .005 (F) = W$$

$$FG = .005 \quad PAT = \frac{1}{600} \quad \text{Safety} = \frac{1}{300}$$

$$54. \quad -.01 (T) - \frac{1}{300} (V) - \frac{1}{600} (P + R + C) + \frac{1}{150} (I) + .005 (F) = W$$

$$FG = -.005 \quad PAT = -\frac{1}{600} \quad \text{Safety} = -\frac{1}{300}$$

$$55. \quad \frac{3}{500} (T) + .002 (V) + \frac{1}{1000} (P + R + C) - .004 (I) - \frac{3}{1000} (F) = W$$

$$FG = \frac{3}{1000} \quad PAT = .001 \quad \text{Safety} = \frac{1}{500}$$

$$56. -\frac{3}{500} (T) - .002 (V) - \frac{1}{1000} (P + R + C) + .004 (I) + \frac{3}{1000} (F) = W$$

$$FG = -\frac{3}{1000} \quad PAT = -.001 \quad \text{Safety} = -\frac{1}{500}$$

$$57. \frac{3}{40} (T) + .025 (V) + .0125 (P + R + C) - \frac{1}{20} (I) - .0375 (F) = W$$

$$FG = .0375 \quad PAT = \frac{1}{80} \quad \text{Safety} = .025$$

$$58. -\frac{3}{40} (T) - .025 (V) - .0125 (P + R + C) + \frac{1}{20} (I) + .0375 (F) = W$$

$$FG = -.0375 \quad PAT = -\frac{1}{80} \quad \text{Safety} = -.025$$

$$59. .06 (T) + \frac{1}{50} (V) + .01 (P + R + C) - \frac{1}{25} (I) - .03 (F) = W$$

$$FG = .03 \quad PAT = \frac{1}{100} \quad \text{Safety} = .02$$

$$60. -.06 (T) - \frac{1}{50} (V) - .01 (P + R + C) + \frac{1}{25} (I) + .03 (F) = W$$

$$FG = -.03 \quad PAT = -\frac{1}{100} \quad \text{Safety} = -.02$$

$$61. \frac{1}{10} (T) + .0\bar{3} (V) + .01\bar{6} (P + R + C) - .0\bar{6} (I) - \frac{1}{20} (F) = W$$

$$FG = \frac{1}{20} \quad PAT = .01\bar{6} \quad \text{Safety} = .0\bar{3}$$

$$62. -\frac{1}{10} (T) - .0\bar{3} (V) - .01\bar{6} (P + R + C) + .0\bar{6} (I) + \frac{1}{20} (F) = W$$

$$FG = -\frac{1}{20} \quad PAT = -.01\bar{6} \quad \text{Safety} = -.0\bar{3}$$

$$63. .15 (T) + \frac{1}{20} (V) + .025 (P + R + C) - \frac{1}{10} (I) - .075 (F) = W$$

$$FG = .075 \quad PAT = \frac{1}{40} \quad \text{Safety} = .05$$

$$64. -.15 (T) - \frac{1}{20} (V) - .025 (P + R + C) + \frac{1}{10} (I) + .075 (F) = W$$

$$FG = -.075 \quad PAT = -\frac{1}{40} \quad \text{Safety} = -.05$$

$$65. \frac{3}{10} (T) + .1 (V) + \frac{1}{20} (P + R + C) - .2 (I) - \frac{3}{20} (F) = W$$

$$FG = \frac{3}{20} \quad PAT = .05 \quad \text{Safety} = \frac{1}{10}$$

$$66. -\frac{3}{10}(T) - .1(V) - \frac{1}{20}(P + R + C) + .2(I) + \frac{3}{20}(F) = W$$

$$FG = -\frac{3}{20} \quad PAT = -.05 \quad \text{Safety} = -\frac{1}{10}$$

$$67. .6(T) + \frac{1}{5}(V) + .1(P + R + C) - \frac{2}{5}(I) - .3(F) = W$$

$$FG = .3 \quad PAT = \frac{1}{10} \quad \text{Safety} = .2$$

$$68. -.6(T) - \frac{1}{5}(V) - .1(P + R + C) + \frac{2}{5}(I) + .3(F) = W$$

$$FG = -.3 \quad PAT = -\frac{1}{10} \quad \text{Safety} = -.2$$

$$69. .9(T) + .3(V) + \frac{3}{20}(P + R + C) - \frac{3}{5}(I) - \frac{9}{20}(F) = W$$

$$FG = .45 \quad PAT = \frac{3}{20} \quad \text{Safety} = .3$$

$$70. -.9(T) - .3(V) - \frac{3}{20}(P + R + C) + \frac{3}{5}(I) + \frac{9}{20}(F) = W$$

$$FG = -.45 \quad PAT = -\frac{3}{20} \quad \text{Safety} = -.3$$

Integers with Positive Exponents

$$71. 2^4(T) + 2^3(V) + 2^2(P + R + C) - 2^1(I) - 2^0(F) = W$$

$$FG = 2^2 \quad PAT = 2^0 \quad \text{Safety} = 2^3$$

$$72. -2^4(T) - 2^3(V) - 2^2(P + R + C) + 2^1(I) + 2^0(F) = W$$

$$FG = -2^2 \quad PAT = -2^0 \quad \text{Safety} = -2^3$$

$$73. 3^4(T) + 3^3(V) + 3^2(P + R + C) - 3^1(I) - 3^0(F) = W$$

$$FG = 3^2 \quad PAT = 3^0 \quad \text{Safety} = 3^3$$

$$74. 4^4(T) + 4^3(V) + 4^2(P + R + C) - 4^1(I) - 4^0(F) = W$$

$$FG = 4^2 \quad PAT = 4^0 \quad \text{Safety} = 4^3$$

$$75. -4^4(T) - 4^3(V) - 4^2(P + R + C) + 4^1(I) + 4^0(F) = W$$

$$FG = -4^2 \quad PAT = -4^0 \quad \text{Safety} = -4^3$$

$$76. 5^4(T) + 5^3(V) + 5^2(P + R + C) - 5^1(I) - 5^0(F) = W$$

$$FG = 5^2 \quad PAT = 5^0 \quad \text{Safety} = 5^3$$

$$77. 6^4(T) + 6^3(V) + 6^2(P + R + C) - 6^1(I) - 6^0(F) = W$$

$$FG = 6^2 \quad PAT = 6^0 \quad \text{Safety} = 6^3$$

$$78. -6^4(T) - 6^3(V) - 6^2(P + R + C) + 6^1(I) + 6^0(F) = W$$

$$FG = -6^2 \quad PAT = -6^0 \quad \text{Safety} = -6^3$$

Integers with Negative Exponents

$$79. 2^0 (T) + 2^{-1} (V) + 2^{-2} (P + R + C) - 2^{-3} (I) - 2^{-4} (F) = W$$
$$FG = 2^{-4} \quad PAT = 2^{-2} \quad \text{Safety} = 2^{-1}$$

$$80. 3^0 (T) + 3^{-1} (V) + 3^{-2} (P + R + C) - 3^{-3} (I) - 3^{-4} (F) = W$$
$$FG = 3^{-4} \quad PAT = 3^{-2} \quad \text{Safety} = 3^{-1}$$

$$81. -3^0 (T) - 3^{-1} (V) - 3^{-2} (P + R + C) + 3^{-3} (I) + 3^{-4} (F) = W$$
$$FG = -3^{-4} \quad PAT = -3^{-2} \quad \text{Safety} = -3^{-1}$$

$$82. 4^0 (T) + 4^{-1} (V) + 4^{-2} (P + R + C) - 4^{-3} (I) - 4^{-4} (F) = W$$
$$FG = 4^{-4} \quad PAT = 4^{-2} \quad \text{Safety} = 4^{-1}$$

$$83. 5^0 (T) + 5^{-1} (V) + 5^{-2} (P + R + C) - 5^{-3} (I) - 5^{-4} (F) = W$$
$$FG = 5^{-4} \quad PAT = 5^{-2} \quad \text{Safety} = 5^{-1}$$

$$84. -5^0 (T) - 5^{-1} (V) - 5^{-2} (P + R + C) + 5^{-3} (I) + 5^{-4} (F) = W$$
$$FG = -5^{-4} \quad PAT = -5^{-2} \quad \text{Safety} = -5^{-1}$$

$$85. 6^0 (T) + 6^{-1} (V) + 6^{-2} (P + R + C) - 6^{-3} (I) - 6^{-4} (F) = W$$
$$FG = 6^{-4} \quad PAT = 6^{-2} \quad \text{Safety} = 6^{-1}$$

Decimals with Positive Exponents

$$86. .3^0 (T) + .3^1 (V) + .3^2 (P + R + C) - .3^3 (I) - .3^4 (F) = W$$
$$FG = .3^4 \quad PAT = .3^2 \quad \text{Safety} = .3^1$$

$$87. .4^0 (T) + .4^1 (V) + .4^2 (P + R + C) - .4^3 (I) - .4^4 (F) = W$$
$$FG = .4^4 \quad PAT = .4^2 \quad \text{Safety} = .4^1$$

$$88. .5^0 (T) + .5^1 (V) + .5^2 (P + R + C) - .5^3 (I) - .5^4 (F) = W$$
$$FG = .5^4 \quad PAT = .5^2 \quad \text{Safety} = .5^1$$

$$89. .6^0 (T) + .6^1 (V) + .6^2 (P + R + C) - .6^3 (I) - .6^4 (F) = W$$
$$FG = .6^4 \quad PAT = .6^2 \quad \text{Safety} = .6^1$$

Decimals with Negative Exponents

$$90. .3^{-4} (T) + .3^{-3} (V) + .3^{-2} (P + R + C) - .3^{-1} (I) - .3^0 (F) = W$$
$$FG = .3^0 \quad PAT = .3^{-2} \quad \text{Safety} = .3^{-3}$$

$$91. .4^{-4} (T) + .4^{-3} (V) + .4^{-2} (P + R + C) - .4^{-1} (I) - .4^0 (F) = W$$
$$FG = .4^0 \quad PAT = .4^{-2} \quad \text{Safety} = .4^{-3}$$

$$92. .5^{-4} (T) + .5^{-3} (V) + .5^{-2} (P + R + C) - .5^{-1} (I) - .5^0 (F) = W$$
$$FG = .5^0 \quad PAT = .5^{-2} \quad \text{Safety} = .5^{-3}$$

$$93. .6^{-4} (T) + .6^{-3} (V) + .6^{-2} (P + R + C) - .6^{-1} (I) - .6^0 (F) = W$$
$$FG = .6^0 \quad PAT = .6^{-2} \quad \text{Safety} = .6^{-3}$$

Fractions with Positive Exponents

$$94. \left(\frac{1}{2}\right)^0 (T) + \left(\frac{1}{2}\right)^1 (V) + \left(\frac{1}{2}\right)^2 (P + R + C) - \left(\frac{1}{2}\right)^3 (I) - \left(\frac{1}{2}\right)^4 (F) = W$$

$$FG = \left(\frac{1}{2}\right)^4 \quad PAT = \left(\frac{1}{2}\right)^2 \quad \text{Safety} = \left(\frac{1}{2}\right)^1$$

$$95. \left(\frac{1}{3}\right)^0 (T) + \left(\frac{1}{3}\right)^1 (V) + \left(\frac{1}{3}\right)^2 (P + R + C) - \left(\frac{1}{3}\right)^3 (I) - \left(\frac{1}{3}\right)^4 (F) = W$$

$$FG = \left(\frac{1}{3}\right)^4 \quad PAT = \left(\frac{1}{3}\right)^2 \quad \text{Safety} = \left(\frac{1}{3}\right)^1$$

$$96. \left(\frac{5}{6}\right)^0 (T) + \left(\frac{4}{5}\right)^1 (V) + \left(\frac{3}{4}\right)^2 (P + R + C) - \left(\frac{2}{7}\right)^3 (I) - \left(\frac{2}{8}\right)^4 (F) = W$$

$$FG = \left(\frac{2}{8}\right)^4 \quad PAT = \left(\frac{3}{4}\right)^2 \quad \text{Safety} = \left(\frac{4}{5}\right)^1$$

Fractions with Negative Exponents

$$97. \left(\frac{2}{8}\right)^{-4} (T) + \left(\frac{2}{7}\right)^{-3} (V) + \left(\frac{3}{4}\right)^{-2} (P + R + C) - \left(\frac{4}{5}\right)^{-1} (I) - \left(\frac{5}{6}\right)^0 (F) = W$$

$$FG = \left(\frac{5}{6}\right)^0 \quad PAT = \left(\frac{3}{4}\right)^{-2} \quad \text{Safety} = \left(\frac{2}{7}\right)^{-3}$$

$$98. \left(\frac{1}{4}\right)^{-4} (T) + \left(\frac{1}{4}\right)^{-3} (V) + \left(\frac{1}{4}\right)^{-2} (P + R + C) - \left(\frac{1}{4}\right)^{-1} (I) - \left(\frac{1}{4}\right)^0 (F) = W$$

$$FG = \left(\frac{1}{4}\right)^0 \quad PAT = \left(\frac{1}{4}\right)^{-2} \quad \text{Safety} = \left(\frac{1}{4}\right)^{-3}$$

Roots

$$99. \sqrt{36} (T) + \sqrt{25} (V) + \sqrt{16} (P + R + C) - \sqrt{9} (I) - \sqrt{4} (F) = W$$

$$FG = \sqrt{4} \quad PAT = \sqrt{16} \quad \text{Safety} = \sqrt{25}$$

$$100. -\sqrt{36} (T) - \sqrt{25} (V) - \sqrt{16} (P + R + C) + \sqrt{9} (I) + \sqrt{4} (F) = W$$

$$FG = -\sqrt{4} \quad PAT = -\sqrt{16} \quad \text{Safety} = -\sqrt{25}$$

$$101. -\sqrt{121} (T) - \sqrt{100} (V) - \sqrt{81} (P + R + C) + \sqrt{64} (I) + \sqrt{49} (F) = W$$

$$FG = \sqrt{49} \quad PAT = \sqrt{81} \quad \text{Safety} = \sqrt{100}$$

$$102. -\sqrt{121} (T) - \sqrt{100} (V) - \sqrt{81} (P + R + C) + \sqrt{64} (I) + \sqrt{49} (F) = W$$

$$FG = -\sqrt{49} \quad PAT = -\sqrt{81} \quad \text{Safety} = -\sqrt{100}$$

$$103. \sqrt{25} (T) + \sqrt[3]{64} (V) + \sqrt[4]{81} (P + R + C) - \sqrt[5]{32} (I) - \sqrt[6]{1} (F) = W$$

$$FG = \sqrt[6]{1} \quad PAT = \sqrt[4]{81} \quad \text{Safety} = \sqrt[3]{64}$$

Factorials and Summations

$$104. 6! (T) + 5! (V) + 4! (P + R + C) - 3! (I) - 2! (F) = W$$

$$FG = 4! \quad PAT = 2! \quad \text{Safety} = 5!$$

$$105. -6! (T) - 5! (V) - 4! (P + R + C) + 3! (I) + 2! (F) = W$$

$$FG = -4! \quad PAT = -2! \quad \text{Safety} = -5!$$

$$106. \left(\sum_{j=1}^6 j \right) (T) + \left(\sum_{j=1}^5 j \right) (V) + \left(\sum_{j=1}^4 j \right) (P + R + C) - \left(\sum_{j=1}^3 j \right) (I) - \left(\sum_{j=1}^2 j \right) (F) = W$$

$$FG = \left(\sum_{j=1}^4 j \right) \quad PAT = \left(\sum_{j=1}^2 j \right) \sum 2 \quad \text{Safety} = \left(\sum_{j=1}^5 j \right)$$

$$107. -\left(\sum_{j=1}^6 j \right) (T) - \left(\sum_{j=1}^5 j \right) (V) - \left(\sum_{j=1}^4 j \right) (P + R + C) + \left(\sum_{j=1}^3 j \right) (I) + \left(\sum_{j=1}^2 j \right) (F) = W$$

$$FG = -\left(\sum_{j=1}^4 j \right) \quad PAT = \left(\sum_{j=1}^2 j \right) - \sum 2 \quad \text{Safety} = -\left(\sum_{j=1}^5 j \right)$$

Fractions, Decimals, Summations, Factorials, Exponents, Roots

$$108. \left(\sum_{j=1}^3 j \right) (T) + \left(\frac{2}{5} \right)^{-1} (V) + 2! (P + R + C) - \left(\frac{5}{6} \right)^0 (I) - \left(\sqrt[4]{16} \right)^{-2} (F) = W$$

$$FG = \left(\sqrt[4]{16} \right)^{-2} \quad PAT = 2! \quad \text{Safety} = \left(\frac{2}{5} \right)^{-1}$$

$$109. -\left(\sum_{j=1}^3 j \right) (T) - \left(\frac{2}{5} \right)^{-1} (V) - 2! (P + R + C) + \left(\frac{5}{6} \right)^0 (I) + \left(\sqrt[4]{16} \right)^{-2} (F) = W$$

$$FG = -\left(\sqrt[4]{16} \right)^{-2} \quad PAT = -2! \quad \text{Safety} = -\left(\frac{2}{5} \right)^{-1}$$

$$110. .2^{-3} (T) + 5! (V) + \left(\sum_{j=1}^6 j \right) (P + R + C) - \sqrt[3]{64} (I) - .025 (F) = W$$

$$FG = .025 \quad PAT = \left(\sum_{j=1}^6 j \right) \quad \text{Safety} = 5!$$

$$111. -.2^{-3} (T) - 5! (V) - \left(\sum_{j=1}^6 j \right) (P + R + C) + \sqrt[3]{64} (I) + .025 (F) = W$$

$$FG = .025 \quad PAT = \left(\sum_{j=1}^6 j \right) \quad \text{Safety} = 5!$$