

BEE/CSS 371 Business of Technology
Winter 2017
Lecture 13

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Tonight's agenda

1. [Presentations](#)
2. [Rose Bowl negotiation results](#)
3. [Time value of money](#)
4. [Intellectual property](#)

Presentations

1. We have 10 teams and only 2 hours.
2. Only 12 minutes/team without a break.
3. Let's try *really hard* for 5 min/team.
4. Easiest is if you have your presentation in PowerPoint on a thumb drive and we use the podium computer.
5. We need to decide the order.

Let's fix the order

- | | |
|--------------------|---------------------------------|
| 1. BEES | STEM Subscription Box |
| 2. The Right Stuff | Pain et Patisserie |
| 3. Asian Pirates | Bothell Hub |
| 4. Enamelton Labs | WasteStream |
| 5. Banana Split | Clothing Simulator |
| 6. GITIT | Japanese Restaurant |
| 7. The Resistance | ASH (Automated Smart Home) Inc. |
| 8. 4.0 Squad | SitWait |
| 9. Team Furious | Wilderness Survival Classes |
| 10. StarTech | TACO Food Truck |

Rose Bowl negotiation

Rose Bowl negotiation

1. A local alumni association is negotiating with a local sports bar about the cost of a buffet at their upcoming Rose Bowl viewing event.
2. Some of you were buyers, representing the alumni, some of you were managers of the sport bar.
3. You were to choose an appetizer and price a buffet menu.
4. Your objective was to get the absolute best price possible.
5. Different pairs did have different information.
 - a) Some sellers were employees who'd recently been hired by a boss who's been avoiding you.
 - b) Other sellers were family, children of the two brothers who'd started the business.

Previous menu, \$12

Build your own nachos, tortilla chips, beef, chicken, queso, guacamole, sour cream, tomatoes, green onion, jalapenos, black olives

5oz hamburgers and buns, cheese, lettuce, tomato, onion slices

Hot dogs and buns

Potato chips (small bags)

Vegetarian chili

Green salad, ranch, Caesar dressing on the side

Exhibit 1. Major Event Grill's published buffet menu.

Build your own buffet! All prices are per person.

Antipasto Plate (V) (G) \$4

Assorted Gourmet Pizzas (V) \$4

Bacon Wrapped Shrimp with a Smokey Remoulade (G) \$5

Teriyaki Chicken & Pineapple Kabobs (G) \$4

Cocktail Crab Cakes with Lemon Aioli \$6

Coconut Crusted Shrimp with Louie Sauce \$5

Crab & Artichoke Dip with Crackers \$5

Creamy Spinach and Artichoke Dip with Tortilla Chips \$3

Crispy Chicken Tenders with Trio of Dipping Sauces \$4

Sliders with Tomato & Cheese (Angus Beef, Chicken, BBQ Pork, Veggie) (V) \$4

Fresh Tomato & Garlic Bruschetta (V) \$3

Pork Pot Stickers with Soy Dipping Sauce \$3

Portabella Mushroom Skewers Stuffed with Roasted Garlic (V) (G) \$3

Skewered Meatballs with Sweet & Spicy BBQ or Garlic-Tomato Sauce \$3

Spanakopita - Filo Triangles Stuffed with Spinach and Feta \$4

Stuffed Mushroom Caps \$3

(choice of bacon (G), cream cheese & onion (G) or spinach & parmesan)

Teriyaki Beef Skewers with Toasted Sesame Seeds (G) \$4

Thai Chicken Skewers with Peanut Dipping Sauce (G) \$4

Vegetable Spring Rolls with Sweet Chili Sauce (V) \$3.50

Zesty Queso Dip with Fresh Tortilla Chips (V) \$3

Quesadilla (Chicken, or Cheese) (V) \$3/\$2.50

(V)=Vegetarian Friendly

(G) = Gluten Free Option

Dessert

Homestyle Cookies \$4

Miniature Cheesecakes \$4

Apple Crisp \$4

Assorted Desserts \$10

Prices do not include sales tax or service charge.

Rose Bowl menu

As Guests Arrive

Stuffed Mushroom Caps with Spinach & Parmesan

Fresh-made Tortilla Chips

Teriyaki Beef Skewers with Toasted Sesame Seeds

One additional appetizer: either Chilled Shrimp with Cocktail Sauce or Deviled Eggs

At Start of Game

Assorted Gourmet Pizzas

French Fries

Angus Beef Sliders with Tomato & Cheese

BBQ Pork Sliders

Roasted Chicken Legs, Thighs and Breasts with Garlic & Rosemary

Tossed Field Greens with Assorted Dressings & Toppings

At Halftime

Apple Crisp

Mini Cheesecakes

Basic questions

1. What is the event?
2. Who will be attending?
3. What is important to them and what can they afford?
4. Will there be a lot of drinking?
5. How many buffets are you negotiating over?
6. What happens if you fail to reach an agreement?
7. What are each side's reserve values?
8. Does either side have solid pricing information?
9. You were asked to get the best price possible but is that really all you should be concerned about?

Results of the Rose Bowl buffet negotiation

Pair	Buyer	Seller	Seller Status	Appetizer	Price \$	1st offer midpoint	Buyer's 1st offer	Seller's 1st offer	# offers
1	Daniel Grimm	Robert Gunther	Family	Eggs	17.00	20.50	6.00	35.00	8
2	Hoa Vo	David Webber	Family	Shrimp	16.00	14.00	8.00	20.00	8
3	Fenrir Hong	Wesley Lai	Family	Shrimp	28.00	28.50	25.00	32.00	5
4	Karinne Barbosa	Sarah Dunning	Employee	Eggs	30.00	30.00	25.00	35.00	9
5	Himson Tam	Chun Yin Ng	Employee	Both	17.00	17.50	10.00	25.00	9
6	Brandon Paper	Miguel Huerta	Family	Both	13.50	11.00	10.00	12.00	8
7	Chiayi Lin	Austen Szypula	Family	Shrimp	16.55	17.00	14.00	20.00	11
8	Arrido Arfiadi	Aliou Traore	Employee	Eggs	30.00	40.00	20.00	60.00	8
9	Abhi Trivedi	Bao Tran	Employee	Eggs	15.00	13.25	11.50	15.00	6
10	John Fitzgerald	Luke Fruhling	Family	Eggs	15.00	12.50	9.00	16.00	8
11	Chris Hoover	Diefa Shabirah	Employee	Shrimp	17.00	16.00	12.00	20.00	14
12	Joe Fiala	Htut Ko	Employee	Shrimp	11.50	15.50	14.00	17.00	13
13	Sridarsh Vinnakota	Regina Bloomstine	Employee	Shrimp	21.75	22.50	23.00	22.00	6
14	Alan Nguyen	Sahjpreet Brar	Employee	Eggs	11.50	12.00	10.00	14.00	11
15	Jin Kim	Aleks Malakhovsky	Family	Eggs	11.09	10.17	8.33	12.00	18
16	Louden Ivey	Tammy Kuo	Family	Shrimp	13.00	26.00	12.00	40.00	11
17	Chris Steigerwald	Sasha Stavila	Family	Shrimp	15.00	20.00	10.00	30.00	14
18	Kevin Muggli	Son Huynh	Employee	Eggs	9.25	10.00	5.00	15.00	7
19	Elliot White	Silviu Gruber	Family	NA	NA	13.50	7.00	20.00	12
20	Christine Sutton	Christine Jeong	Family	Eggs	18.00	20.00	15.00	25.00	6
21	Farah Hasan	Dean Ferris	Family	Shrimp	29.00	26.50	25.00	28.00	4
22	Hans Nicolaus	Brandon Hoang	Employee	Eggs	21.00	21.00	12.00	30.00	12
23	Taliesin Langford	Christian Carlos	Employee	Shrimp	16.80	17.00	15.00	19.00	6
	First offers are in red		High		30.00	40.00	25.00	60.00	18
			Average		17.86	18.89	13.34	24.43	9
			Low		9.25	10.00	5.00	12.00	4

Sorted by Price

Pair	Buyer	Seller	Seller Status	Appetizer	Price \$	1st offer midpoint	Buyer's 1st offer	Seller's 1st offer	# offers
19	Elliot White	Silviu Gruber	Family	NA	NA	13.50	7.00	20.00	12
4	Karinne Barbosa	Sarah Dunning	Employee	Eggs	30.00	30.00	25.00	35.00	9
8	Arrido Arfiadi	Aliou Traore	Employee	Eggs	30.00	40.00	20.00	60.00	8
21	Farah Hasan	Dean Ferris	Family	Shrimp	29.00	26.50	25.00	28.00	4
3	Fenrir Hong	Wesley Lai	Family	Shrimp	28.00	28.50	25.00	32.00	5
13	Sridarsh Vinnakota	Regina Bloomstine	Employee	Shrimp	21.75	22.50	23.00	22.00	6
22	Hans Nicolaus	Brandon Hoang	Employee	Eggs	21.00	21.00	12.00	30.00	12
20	Christine Sutton	Christine Jeong	Family	Eggs	18.00	20.00	15.00	25.00	6
1	Daniel Grimm	Robert Gunther	Family	Eggs	17.00	20.50	6.00	35.00	8
5	Himson Tam	Chun Yin Ng	Employee	Both	17.00	17.50	10.00	25.00	9
11	Chris Hoover	Diefa Shabirah	Employee	Shrimp	17.00	16.00	12.00	20.00	14
23	Taliesin Langford	Christian Carlos	Employee	Shrimp	16.80	17.00	15.00	19.00	6
7	Chiayi Lin	Austen Szypula	Family	Shrimp	16.55	17.00	14.00	20.00	11
2	Hoa Vo	David Webber	Family	Shrimp	16.00	14.00	8.00	20.00	8
9	Abhi Trivedi	Bao Tran	Employee	Eggs	15.00	13.25	11.50	15.00	6
10	John Fitzgerald	Luke Fruhling	Family	Eggs	15.00	12.50	9.00	16.00	8
17	Chris Steigerwald	Sasha Stavila	Family	Shrimp	15.00	20.00	10.00	30.00	14
6	Brandon Paper	Miguel Huerta	Family	Both	13.50	11.00	10.00	12.00	8
16	Louden Ivey	Tammy Kuo	Family	Shrimp	13.00	26.00	12.00	40.00	11
12	Joe Fiala	Htut Ko	Employee	Shrimp	11.50	15.50	14.00	17.00	13
14	Alan Nguyen	Sahjpreet Brar	Employee	Eggs	11.50	12.00	10.00	14.00	11
15	Jin Kim	Aleks Malakhovsky	Family	Eggs	11.09	10.17	8.33	12.00	18
18	Kevin Muggli	Son Huynh	Employee	Eggs	9.25	10.00	5.00	15.00	7

Sorted by appetizer

Pair	Buyer	Seller	Seller Status	Appetizer	Price \$	1st offer midpoint	Buyer's 1st offer	Seller's 1st offer	# offers
5	Himson Tam	Chun Yin Ng	Employee	Both	17.00	17.50	10.00	25.00	9
6	Brandon Paper	Miguel Huerta	Family	Both	13.50	11.00	10.00	12.00	8
4	Karinne Barbosa	Sarah Dunning	Employee	Eggs	30.00	30.00	25.00	35.00	9
8	Arrido Arfiadi	Aliou Traore	Employee	Eggs	30.00	40.00	20.00	60.00	8
22	Hans Nicolaus	Brandon Hoang	Employee	Eggs	21.00	21.00	12.00	30.00	12
20	Christine Sutton	Christine Jeong	Family	Eggs	18.00	20.00	15.00	25.00	6
1	Daniel Grimm	Robert Gunther	Family	Eggs	17.00	20.50	6.00	35.00	8
9	Abhi Trivedi	Bao Tran	Employee	Eggs	15.00	13.25	11.50	15.00	6
10	John Fitzgerald	Luke Fruhling	Family	Eggs	15.00	12.50	9.00	16.00	8
14	Alan Nguyen	Sahjpreet Brar	Employee	Eggs	11.50	12.00	10.00	14.00	11
15	Jin Kim	Aleks Malakhovsky	Family	Eggs	11.09	10.17	8.33	12.00	18
18	Kevin Muggli	Son Huynh	Employee	Eggs	9.25	10.00	5.00	15.00	7
19	Elliot White	Silviu Gruber	Family	NA	NA	13.50	7.00	20.00	12
21	Farah Hasan	Dean Ferris	Family	Shrimp	29.00	26.50	25.00	28.00	4
3	Fenrir Hong	Wesley Lai	Family	Shrimp	28.00	28.50	25.00	32.00	5
13	Sridarsh Vinnakota	Regina Bloomstine	Employee	Shrimp	21.75	22.50	23.00	22.00	6
11	Chris Hoover	Diefa Shabirah	Employee	Shrimp	17.00	16.00	12.00	20.00	14
23	Taliesin Langford	Christian Carlos	Employee	Shrimp	16.80	17.00	15.00	19.00	6
7	Chiayi Lin	Austen Szypula	Family	Shrimp	16.55	17.00	14.00	20.00	11
2	Hoa Vo	David Webber	Family	Shrimp	16.00	14.00	8.00	20.00	8
17	Chris Steigerwald	Sasha Stavila	Family	Shrimp	15.00	20.00	10.00	30.00	14
16	Louden Ivey	Tammy Kuo	Family	Shrimp	13.00	26.00	12.00	40.00	11
12	Joe Fiala	Htut Ko	Employee	Shrimp	11.50	15.50	14.00	17.00	13

Sorted by buyer's first offer

Pair	Buyer	Seller	Seller Status	Appetizer	Price \$	1st offer midpoint	Buyer's 1st offer	Seller's 1st offer	# offers
4	Karinne Barbosa	Sarah Dunning	Employee	Eggs	30.00	30.00	25.00	35.00	9
21	Farah Hasan	Dean Ferris	Family	Shrimp	29.00	26.50	25.00	28.00	4
3	Fenrir Hong	Wesley Lai	Family	Shrimp	28.00	28.50	25.00	32.00	5
13	Sridarsh Vinnakota	Regina Bloomstine	Employee	Shrimp	21.75	22.50	23.00	22.00	6
8	Arrido Arfiadi	Aliou Traore	Employee	Eggs	30.00	40.00	20.00	60.00	8
20	Christine Sutton	Christine Jeong	Family	Eggs	18.00	20.00	15.00	25.00	6
23	Taliesin Langford	Christian Carlos	Employee	Shrimp	16.80	17.00	15.00	19.00	6
7	Chiayi Lin	Austen Szygula	Family	Shrimp	16.55	17.00	14.00	20.00	11
12	Joe Fiala	Htut Ko	Employee	Shrimp	11.50	15.50	14.00	17.00	13
22	Hans Nicolaus	Brandon Hoang	Employee	Eggs	21.00	21.00	12.00	30.00	12
11	Chris Hoover	Diefa Shabirah	Employee	Shrimp	17.00	16.00	12.00	20.00	14
16	Louden Ivey	Tammy Kuo	Family	Shrimp	13.00	26.00	12.00	40.00	11
9	Abhi Trivedi	Bao Tran	Employee	Eggs	15.00	13.25	11.50	15.00	6
5	Himson Tam	Chun Yin Ng	Employee	Both	17.00	17.50	10.00	25.00	9
6	Brandon Paper	Miguel Huerta	Family	Both	13.50	11.00	10.00	12.00	8
14	Alan Nguyen	Sahjpreet Brar	Employee	Eggs	11.50	12.00	10.00	14.00	11
17	Chris Steigerwald	Sasha Stabila	Family	Shrimp	15.00	20.00	10.00	30.00	14
10	John Fitzgerald	Luke Fruhling	Family	Eggs	15.00	12.50	9.00	16.00	8
15	Jin Kim	Aleks Malakhovsky	Family	Eggs	11.09	10.17	8.33	12.00	18
2	Hoa Vo	David Webber	Family	Shrimp	16.00	14.00	8.00	20.00	8
19	Elliot White	Silviu Gruber	Family	NA	NA	13.50	7.00	20.00	12
1	Daniel Grimm	Robert Gunther	Family	Eggs	17.00	20.50	6.00	35.00	8
18	Kevin Muggli	Son Huynh	Employee	Eggs	9.25	10.00	5.00	15.00	7

Sorted by seller's first offer

Pair	Buyer	Seller	Seller Status	Appetizer	Price \$	1st offer midpoint	Buyer's 1st offer	Seller's 1st offer	# offers
8	Arrido Arfiadi	Aliou Traore	Employee	Eggs	30.00	40.00	20.00	60.00	8
16	Louden Ivey	Tammy Kuo	Family	Shrimp	13.00	26.00	12.00	40.00	11
4	Karinne Barbosa	Sarah Dunning	Employee	Eggs	30.00	30.00	25.00	35.00	9
1	Daniel Grimm	Robert Gunther	Family	Eggs	17.00	20.50	6.00	35.00	8
3	Fenrir Hong	Wesley Lai	Family	Shrimp	28.00	28.50	25.00	32.00	5
22	Hans Nicolaus	Brandon Hoang	Employee	Eggs	21.00	21.00	12.00	30.00	12
17	Chris Steigerwald	Sasha Stavila	Family	Shrimp	15.00	20.00	10.00	30.00	14
21	Farah Hasan	Dean Ferris	Family	Shrimp	29.00	26.50	25.00	28.00	4
20	Christine Sutton	Christine Jeong	Family	Eggs	18.00	20.00	15.00	25.00	6
5	Himson Tam	Chun Yin Ng	Employee	Both	17.00	17.50	10.00	25.00	9
13	Sridarsh Vinnakota	Regina Bloomstine	Employee	Shrimp	21.75	22.50	23.00	22.00	6
7	Chiayi Lin	Austen Szygula	Family	Shrimp	16.55	17.00	14.00	20.00	11
11	Chris Hoover	Diefa Shabirah	Employee	Shrimp	17.00	16.00	12.00	20.00	14
2	Hoa Vo	David Webber	Family	Shrimp	16.00	14.00	8.00	20.00	8
19	Elliot White	Silviu Gruber	Family	NA	NA	13.50	7.00	20.00	12
23	Taliesin Langford	Christian Carlos	Employee	Shrimp	16.80	17.00	15.00	19.00	6
12	Joe Fiala	Htut Ko	Employee	Shrimp	11.50	15.50	14.00	17.00	13
10	John Fitzgerald	Luke Fruhling	Family	Eggs	15.00	12.50	9.00	16.00	8
9	Abhi Trivedi	Bao Tran	Employee	Eggs	15.00	13.25	11.50	15.00	6
18	Kevin Muggli	Son Huynh	Employee	Eggs	9.25	10.00	5.00	15.00	7
14	Alan Nguyen	Sahjpreet Brar	Employee	Eggs	11.50	12.00	10.00	14.00	11
6	Brandon Paper	Miguel Huerta	Family	Both	13.50	11.00	10.00	12.00	8
15	Jin Kim	Aleks Malakhovsky	Family	Eggs	11.09	10.17	8.33	12.00	18

Sorted by buyer's score

Pair	Buyer	Seller	Seller Status	Appetizer	Buyer's 1st offer		Seller's 1st offer		# offers	Buyer's score
					Price \$					
16	Louden Ivey	Tammy Kuo	Family	Shrimp	13.00	12.00	40.00		11	6
17	Chris Steigerwald	Sasha Stavila	Family	Shrimp	15.00	10.00	30.00		14	6
7	Chiayi Lin	Austen Szypula	Family	Shrimp	16.55	14.00	20.00		11	6
11	Chris Hoover	Diefa Shabirah	Employee	Shrimp	17.00	12.00	20.00		14	6
12	Joe Fiala	Htut Ko	Employee	Shrimp	11.50	14.00	17.00		13	6
5	Himson Tam	Chun Yin Ng	Employee	Both	17.00	10.00	25.00		9	5
23	Taliesin Langford	Christian Carlos	Employee	Shrimp	16.80	15.00	19.00		6	5
6	Brandon Paper	Miguel Huerta	Family	Both	13.50	10.00	12.00		8	5
3	Fenrir Hong	Wesley Lai	Family	Shrimp	28.00	25.00	32.00		5	4
22	Hans Nicolaus	Brandon Hoang	Employee	Eggs	21.00	12.00	30.00		12	4
21	Farah Hasan	Dean Ferris	Family	Shrimp	29.00	25.00	28.00		4	4
13	Sridarsh Vinnakota	Regina Bloomstine	Employee	Shrimp	21.75	23.00	22.00		6	4
2	Hoa Vo	David Webber	Family	Shrimp	16.00	8.00	20.00		8	4
9	Abhi Trivedi	Bao Tran	Employee	Eggs	15.00	11.50	15.00		6	4
14	Alan Nguyen	Sahjpreet Brar	Employee	Eggs	11.50	10.00	14.00		11	4
20	Christine Sutton	Christine Jeong	Family	Eggs	18.00	15.00	25.00		6	3
1	Daniel Grimm	Robert Gunther	Family	Eggs	17.00	6.00	35.00		8	2
10	John Fitzgerald	Luke Fruhling	Family	Eggs	15.00	9.00	16.00		8	2
15	Jin Kim	Aleks Malakhovsky	Family	Eggs	11.09	8.33	12.00		18	2
18	Kevin Muggli	Son Huynh	Employee	Eggs	9.25	5.00	15.00		7	1
8	Arrido Arfiadi	Aliou Traore	Employee	Eggs	30.00	20.00	60.00		8	0
4	Karinne Barbosa	Sarah Dunning	Employee	Eggs	30.00	25.00	35.00		9	0
19	Elliot White	Silviu Gruber	Family	NA	NA	7.00	20.00		12	0

Buyer scoring: Each Pink = 0, Yellow = 1, Green = 2. Price: Yellow = 2, <\$10 = 1

Sorted by seller's score

Pair	Buyer	Seller	Seller Status	Appetizer	Price \$	Buyer's 1st offer	Seller's 1st offer	# offers	Seller's score
17	Chris Steigerwald	Sasha Stavila	Family	Shrimp	15.00	10.00	30.00	14	6
13	Sridarsh Vinnakota	Regina Bloomstine	Employee	Shrimp	21.75	23.00	22.00	6	6
3	Fenrir Hong	Wesley Lai	Family	Shrimp	28.00	25.00	32.00	5	5
21	Farah Hasan	Dean Ferris	Family	Shrimp	29.00	25.00	28.00	4	5
5	Himson Tam	Chun Yin Ng	Employee	Both	17.00	10.00	25.00	9	5
7	Chiayi Lin	Austen Szypula	Family	Shrimp	16.55	14.00	20.00	11	5
11	Chris Hoover	Diefa Shabirah	Employee	Shrimp	17.00	12.00	20.00	14	5
2	Hoa Vo	David Webber	Family	Shrimp	16.00	8.00	20.00	8	5
23	Taliesin Langford	Christian Carlos	Employee	Shrimp	16.80	15.00	19.00	6	5
1	Daniel Grimm	Robert Gunther	Family	Eggs	17.00	6.00	35.00	8	4
22	Hans Nicolaus	Brandon Hoang	Employee	Eggs	21.00	12.00	30.00	12	4
20	Christine Sutton	Christine Jeong	Family	Eggs	18.00	15.00	25.00	6	4
16	Louden Ivey	Tammy Kuo	Family	Shrimp	13.00	12.00	40.00	11	3
12	Joe Fiala	Htut Ko	Employee	Shrimp	11.50	14.00	17.00	13	3
14	Alan Nguyen	Sahjpreet Brar	Employee	Eggs	11.50	10.00	14.00	11	3
15	Jin Kim	Aleks Malakhovsky	Family	Eggs	11.09	8.33	12.00	18	3
4	Karinne Barbosa	Sarah Dunning	Employee	Eggs	30.00	25.00	35.00	9	2
10	John Fitzgerald	Luke Fruhling	Family	Eggs	15.00	9.00	16.00	8	2
9	Abhi Trivedi	Bao Tran	Employee	Eggs	15.00	11.50	15.00	6	2
6	Brandon Paper	Miguel Huerta	Family	Both	13.50	10.00	12.00	8	2
19	Elliot White	Silviu Gruber	Family	NA	NA	7.00	20.00	12	1
8	Arrido Arfiadi	Aliou Traore	Employee	Eggs	30.00	20.00	60.00	8	0
18	Kevin Muggli	Son Huynh	Employee	Eggs	9.25	5.00	15.00	7	0

Seller scoring: Each Pink = 0, Yellow = 1, Green = 2

Pricing

Reality check #1



Reality check #2



Signature Subs

Regular Footlong **\$8.00** Regular 6-inch **\$5.50**
 12*Cal 630-1160

- 370 Sweet Onion Chicken Teriyaki
- 310 Subway Club®
Turkey Breast, Black Forest Ham & Roast Beef
- 370 Subway Melt®
Turkey Breast, Black Forest Ham, Bacon & Cheese
- 420 Buffalo Chicken

Premium Footlong **\$8.50** Premium 6-inch **\$5.75**
 12*Cal 630-1160

- 380 Steak & Cheese
- 320 Roast Beef
- 570 Chicken & Bacon Ranch Melt

Make It A Meal



Add a 21oz. fountain drink and a side for **\$2.75**



Substitute a Bottled Beverage for your Fountain Drink **.50**

Supreme Footlong **\$9.25** Supreme 6-inch **\$6.25**
 12*Cal 1010-1160

- 500 Big Philly Cheesesteak
- 580 Pastrami Melt
- 430 Turkey & Bacon Avocado



Big Philly Cheesesteak

To meet the American Heart Association nutritional criteria, certified meals include designated 6" sub built to standard formula and include apple slices and water. Visit Subway.com/heartcheck for details. While many factors affect heart disease, diets low in saturated fat and cholesterol may reduce the risk of this disease. *Calories and claim based on 6" sub prepared on Italian or 9-grain wheat bread according to standard recipe. Double these values for Footlong selections.

Signature Subs

- | | | | | |
|-----|--|-------------------|-------------------|--|
| | Regular | Regular | Premium | Premium |
| | \$8.00 | \$5.50 | \$8.50 | \$5.75 |
| | 12*Cal 630 | 1160 | 12*Cal 630 | 1160 |
| 370 | ♥ Sweet Onion Chicken Teriyaki  | | 380 | Steak & Cheese |
| 310 | ♥ Subway Club® 
Turkey Breast, Black Forest Ham & Roast Beef | | 320 | ♥ Roast Beef  |
| 370 | Subway Melt®
Turkey Breast, Black Forest Ham, Bacon & Cheese | | 570 | Chicken & Bacon Ranch Melt |
| 420 | Buffalo Chicken | | | |

Make It A Meal

Add a 21oz. fountain drink and a side for **\$2.75**




Substitute a Bottled Beverage for your Fountain Drink **.50**

- | | | |
|-----|------------------------|-------------------|
| | Suprema | Suprema |
| | \$9.25 | \$6.25 |
| | 12*Cal 1010 | 1160 |
| 500 | Big Philly Cheesesteak | |
| 580 | Pastrami Melt | |
| 430 | Turkey & Bacon Avocado | |



Big Philly Cheesesteak

To meet the American Heart Association nutritional criteria, certified meals include designated 6" sub built to standard formula and include apple slices and water. Visit Subway.com/heartcheck for details. While many factors affect heart disease, diets low in saturated fat and cholesterol may reduce the risk of this disease. *Calories and  claim based on 6" sub prepared on Italian or 9-grain wheat bread according to standard recipe. Double these values for Footlong selections.

Reality check #3

www.themetropolitangrill.com/wp-content/uploads/Met-Dinner.pdf

Seattle PI WSJ WSJ NY Times Krugman FedEx BofA Wikipedia MightyText 371 Entrepreneurship Student IP Other bookmarks

STARTERS

OHMI CARPACCIO* 23.
Thinly sliced Japanese A-5 Ohmi beef served with micro arugula tossed in lemon truffle dressing, caper berries, shaved black truffles, Maldon flake sea salt.

CAPRESE SALAD 11.
Vine ripe tomatoes, fresh mozzarella, grilled sweet onions, micro greens, basil oil and balsamic syrup.

SPRING CAULIFLOWER 9.
Grilled over mesquite coals, feta cheese, roasted Marcona almonds, kalamata olives, Spanish extra virgin olive oil and teardrop tomatoes.

ENTREES

OREGON KING SALMON* 44.
Simply grilled over mesquite served with lemon chive beurre blanc and Yukon Gold mashed potatoes.

BUFFALO TENDERLOIN* 49.
Pan seared Wyoming grass feed buffalo served with roasted morel mushroom butter and root vegetable hash.

METROPOLITAN GRILL FEATURED AMERICAN WAGYU— NATURAL BEEF

Snake River Farms, Idaho

Snake River Farms is a family-owned business, which began over a decade ago with a small herd of Wagyu cattle from the Kobe region of Japan.

The Wagyu bulls were crossed with premium American Black Angus to form a proprietary herd that has developed into one of the finest groups of Wagyu/Angus cross cattle in the U.S. Often referred to as American Kobe Beef, this unique breed was bred specifically to deliver the finest eating quality.

Every step in the production process is strictly controlled to ensure that this level of distinction is achieved.

**35 DAY DRY AGED CHICAGO CUT
TOP SIRLOIN, 18 OZ.* 59.**

SKIRT STEAK, 10 OZ.* 46.

FILET MIGNON, 8 OZ.* 65.

<http://www.themetropolitangrill.com/wp-content/uploads/Met-Dinner.pdf>

in real life

Minus the completely imaginary drama, I actually did this negotiation in 2012 with the World Sports Grill in Seattle on behalf of the Stanford Alumni Club of Seattle.

The actual price I got was \$18.

Non-serious offers

- Would a real buyer offer \$5?
- Would a real seller try to charge \$60?
- What would actually happen?

How many buffets is this?

As Guests Arrive

Stuffed Mushroom Caps with Spinach & Parmesan

Fresh-made Tortilla Chips

Teriyaki Beef Skewers with Toasted Sesame Seeds

One additional appetizer: either Chilled Shrimp with Cocktail Sauce or Deviled Eggs

At Start of Game

Assorted Gourmet Pizzas

French Fries

Angus Beef Sliders with Tomato & Cheese

BBQ Pork Sliders

Roasted Chicken Legs, Thighs and Breasts with Garlic & Rosemary

Tossed Field Greens with Assorted Dressings & Toppings

At Halftime

Apple Crisp

Mini Cheesecakes

Eggs or shrimp

the deviled eggs

Who wants them?

Is it important to the buyer?

What difference does that make to the seller?

How hard can this be?

FOOLPROOF BOILED EGGS

MAKES 6 EGGS

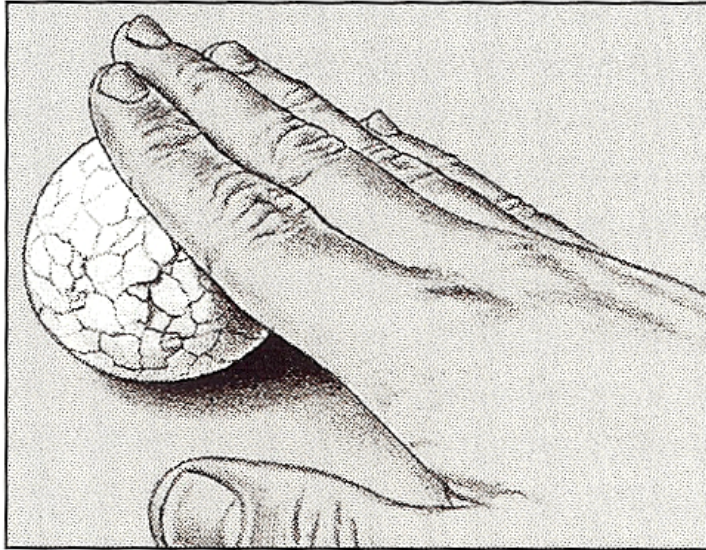
You may double or triple this recipe as long as you use a pot large enough to hold the eggs in a single layer, covered by an inch of water.

6 large eggs

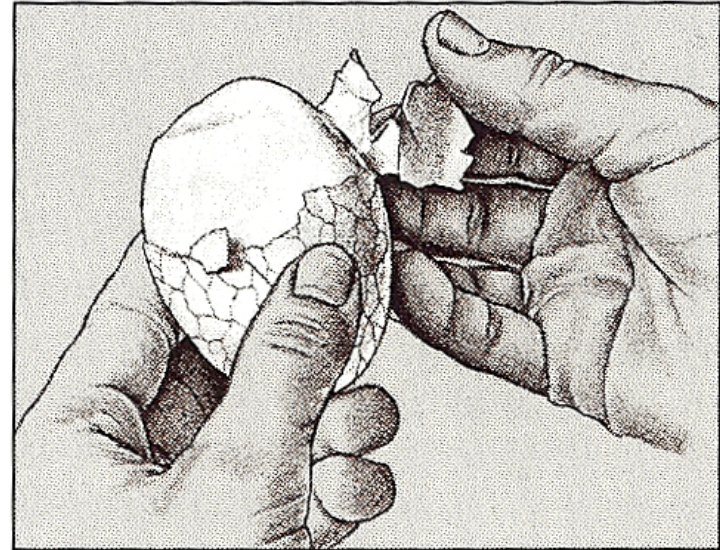
Place eggs in medium saucepan, cover with 1 inch of water, and bring to boil over high heat. Remove pan from heat, cover, and let sit for 10 minutes. Meanwhile, fill a medium bowl with 1 quart water and 1 tray of ice cubes (or equivalent). Transfer eggs to ice water bath with slotted spoon; let sit 5 minutes. Following illustrations 1 and 2, peel and use as desired, or proceed with one of the salad recipes on page 15.

Source: *Cook's Illustrated*, March/April 1999, p. 14

STEP-BY-STEP | FOOLPROOF PEELING



1. Tap the egg all over against the counter surface, then roll it gently back and forth a few times on the counter.



2. Begin peeling from the air pocket end. The shell should come off in spiral strips attached to the thin membrane.

(SERVES 4)

DEILED EGGS

If you want the eggs to look elegant, use a pastry tube to pipe the creamy yolk mixture into the white. Imaginative garnishes such as a fat caper on top or a cross of slivers of green or red pepper, a slice of olive or pickle, a sprinkling of fresh herbs or watercress, makes stuffed eggs particularly lovely.

4 hard-boiled eggs (p. 341)
3 tablespoons mayonnaise
1 teaspoon Dijon mustard
Salt

Freshly ground pepper
1 tablespoon minced parsley or fresh
herbs (optional)

Shell the eggs and slice them in half lengthwise. Remove the yolks and mash them with the mayonnaise, mustard, and salt and pepper to taste until it is smoothly blended and creamy. Stuff equal amounts into the hollow of each egg white. Sprinkle parsley or fresh herbs on top, if desired.

Anchovy-stuffed Eggs. Omit the mustard and add *1–1½ teaspoons anchovy paste*, to taste.

Ham-stuffed Eggs. Add *1 heaping tablespoon finely chopped ham* to the filling.

Cheese-stuffed Eggs. Use *2 tablespoons freshly grated Parmesan cheese* instead of the mustard.

Curried-stuffed Eggs. Add *2 teaspoons curry powder* to the filling.

Source: Marion Cunningham, *The Fannie Farmer Cookbook*, p. 57

You also have to
make them look
nice.



Source: https://en.wikipedia.org/wiki/Deviled_egg

Cold boiled shrimp recipe

1. Thaw.
2. Serve.

Raw materials cost comparison

Deviled eggs

Assuming 3 eggs: ~ \$1

Shrimp

Assuming 5 large shrimp: ~ \$4

But ...

You have to know where to get the already-peeled eggs.

You still have to make them and they need to look nice.

You have to clean up anything that's dropped.

Shrimp *looks* higher value and takes almost no work at all.

I've been looking for
an easier way.

I have not found it.



Recently discovered
at Costco.

But you still have to
make the deviled
eggs.



In real life

When I did this negotiation, I actually did ask about deviled eggs.

The manager *instantly* pointed out and explained why it would be really difficult in her kitchen with her staff.

Time value of money

Concept of equivalence

Payments that differ in magnitude but are made *at different dates* may be financially ***equivalent*** when discounted at an interest rate.

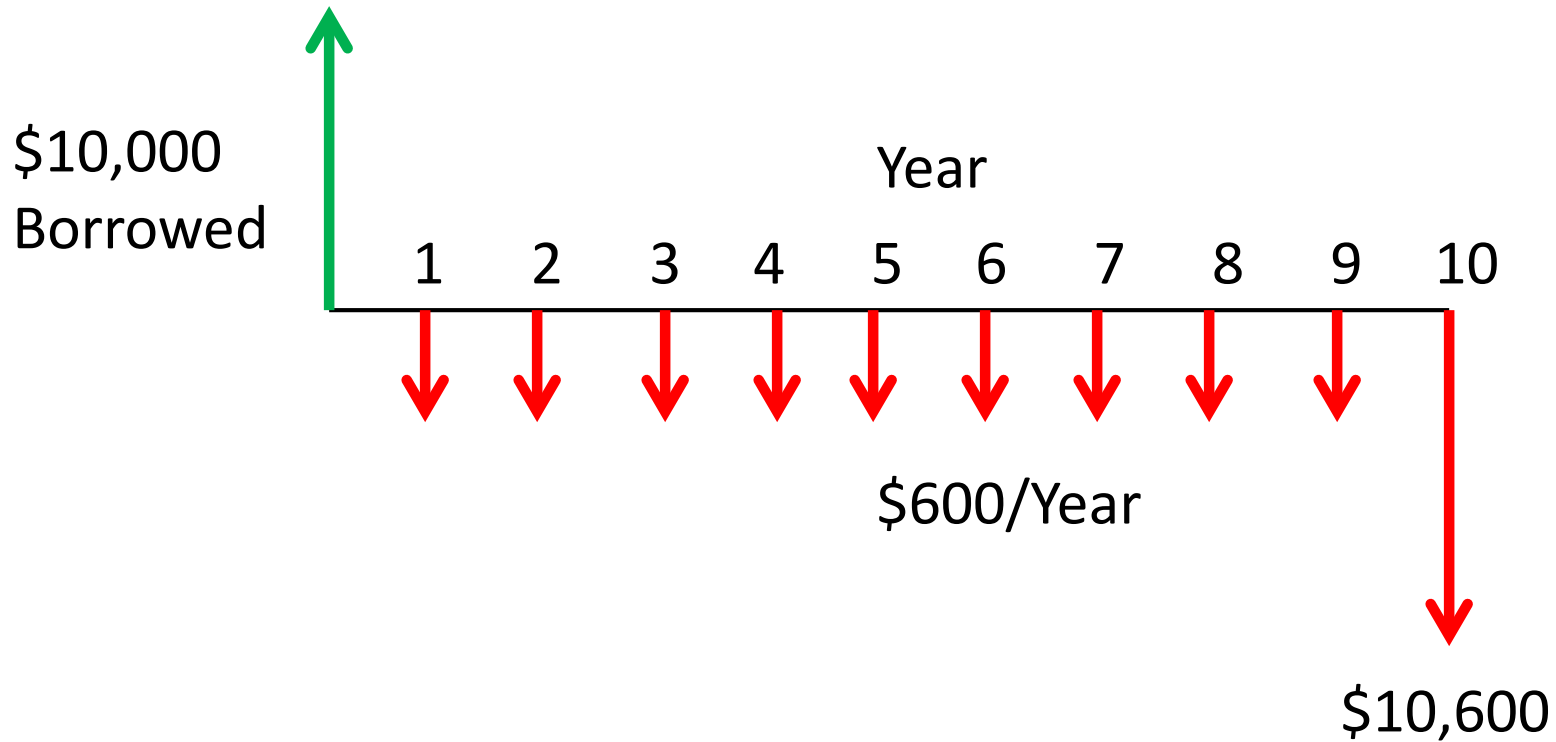
Example

You borrow \$10,000 for 10 years at 6% compounded annually.

Any number of repayment schedules might be *equivalent*.

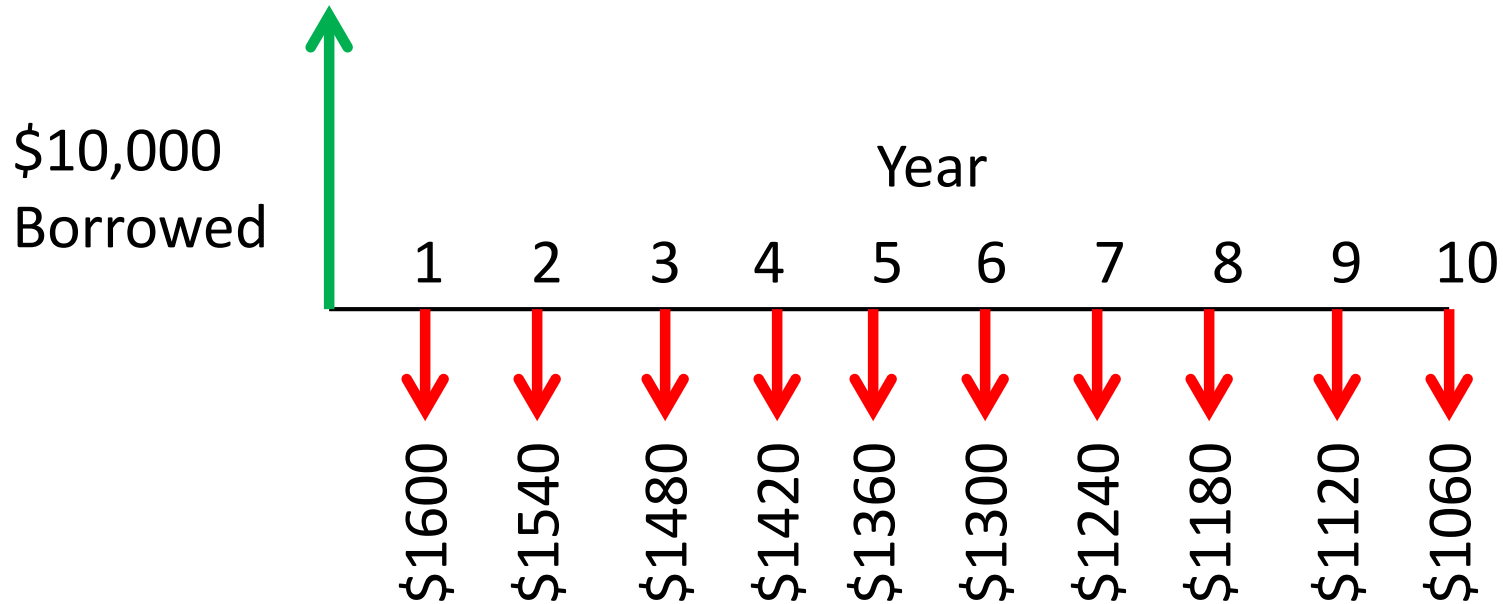
To examine them, we use *cash flow diagrams*.

Interest only + balloon at the end

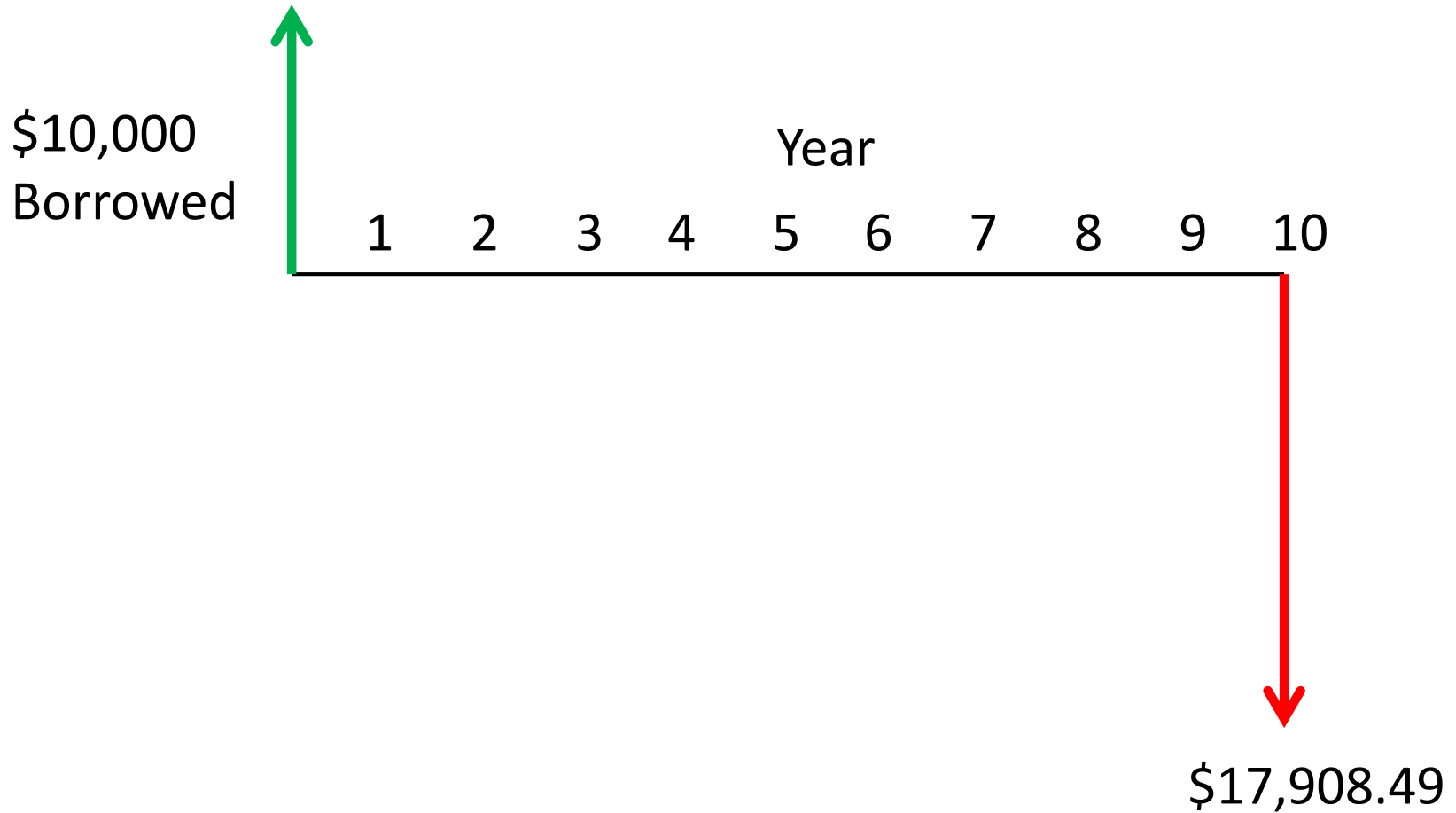


Source: Grant & Ireson, *Principles of Engineering Economy, 5th Ed.*, pg. 28.

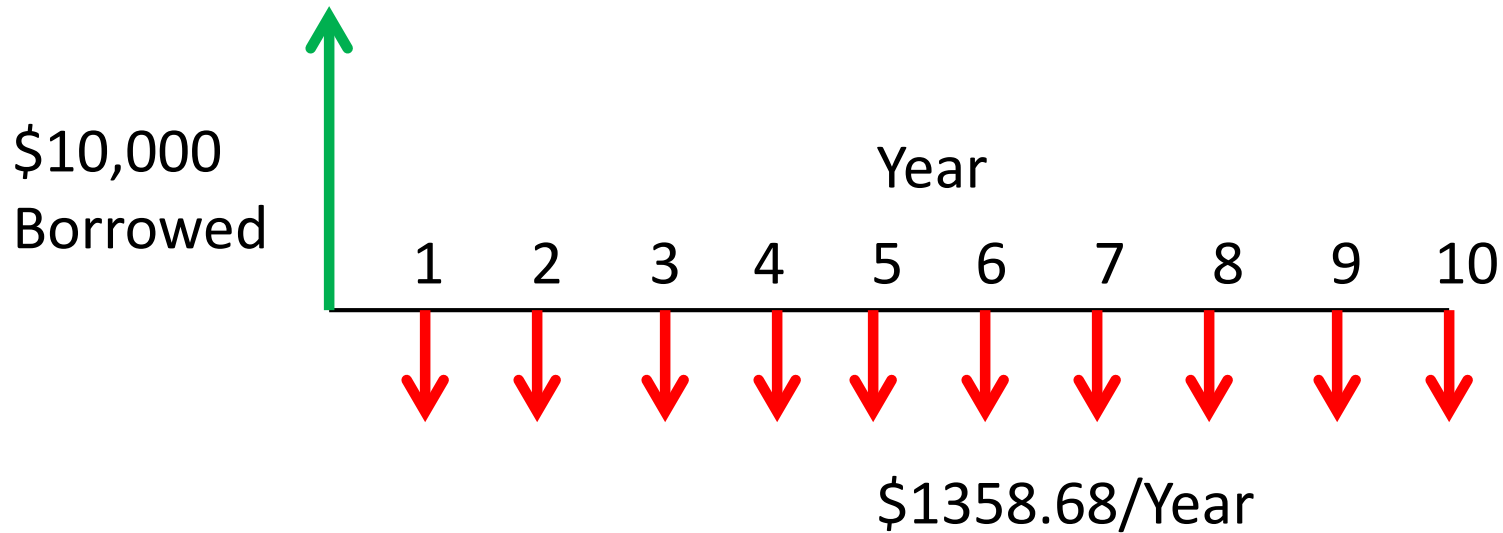
Fixed principal + interest



Single payment



An annuity



A series of equal payments at the end of each period is called an ***annuity***.

Terms

Present value is the value today of any series of discounted payments.

Future value is the value at some future date of any series of discounted payments.

$P =$ Present value

$F =$ Future value

$A =$ Annuity amount at each period

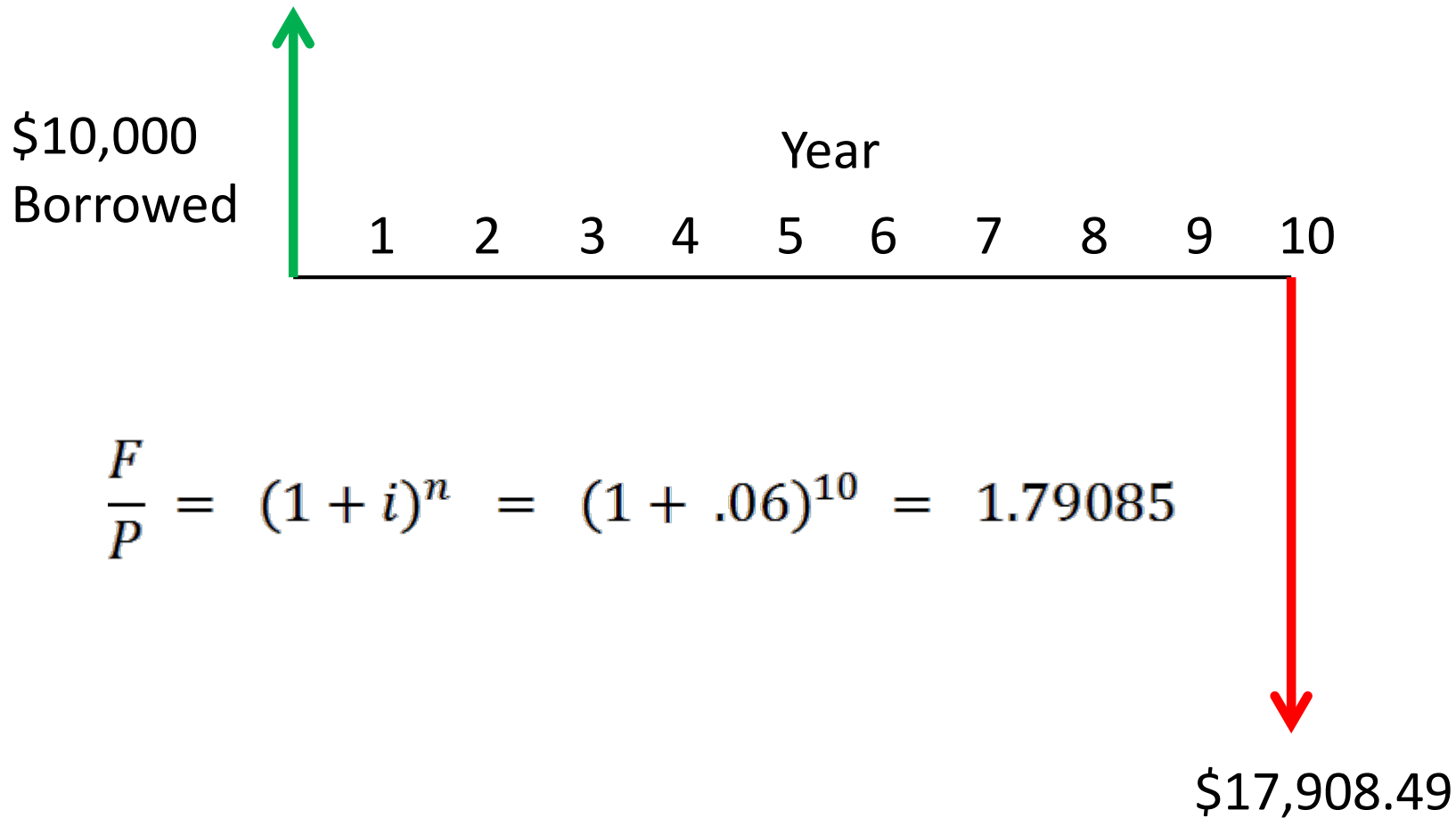
$n =$ Number of periods

$i =$ Interest rate per period

Present and future

$$\frac{F}{P} = (1 + i)^n$$

$$\frac{P}{F} = \frac{1}{(1 + i)^n}$$



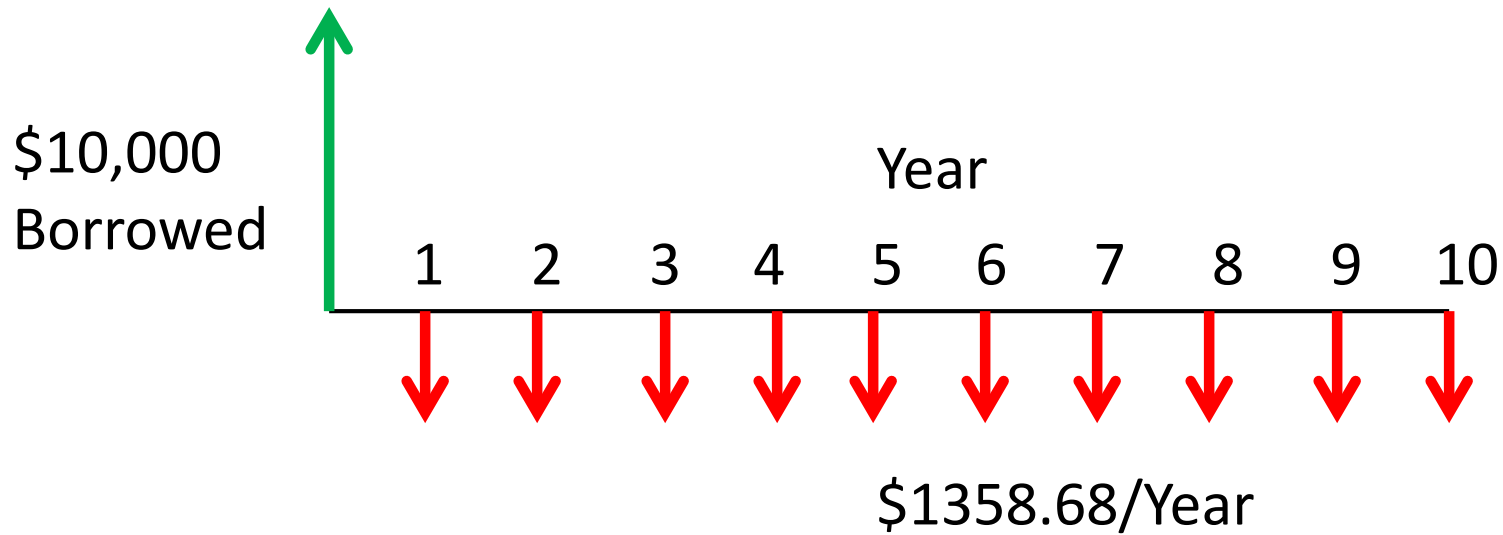
Annuities

$$\frac{P}{A} = \frac{(1+i)^n - 1}{i(1+i)^n}$$

$$\frac{A}{P} = \frac{i(1+i)^n}{(1+i)^n - 1}$$

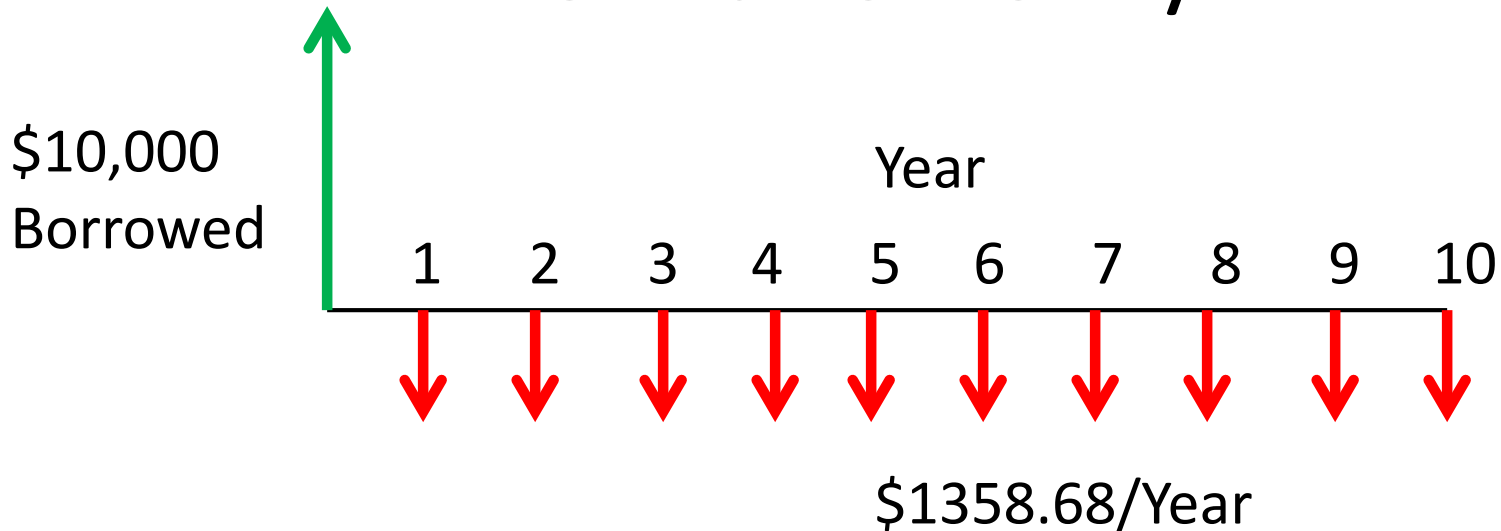
$$\frac{F}{A} = \frac{(1+i)^n - 1}{i}$$

$$\frac{A}{F} = \frac{i}{(1+i)^n - 1}$$



$$\frac{A}{P} = \frac{i(1+i)^n}{(1+i)^n - 1} = \frac{(.06)(1.06)^{10}}{(1.06)^{10} - 1} = 0.13587$$

Derivation of P/A



The present value of an annuity is the sum of the present values of the individual payments.

$$\frac{P}{A} = \sum_{j=1}^n \frac{1}{(1+i)^j}$$

This is a *power series*.

Power series

$$s = \sum_{j=1}^n \frac{1}{r^j} = \frac{1}{r} + \frac{1}{r^2} + \frac{1}{r^3} + \dots + \frac{1}{r^n}$$

$$rs = 1 + \frac{1}{r} + \frac{1}{r^2} + \frac{1}{r^3} + \dots + \frac{1}{r^{n-1}}$$

$$rs - s = s(r - 1) = 1 - \frac{1}{r^n}$$

$$s = \frac{1}{r - 1} - \frac{1}{r^n(r - 1)} = \frac{r^n - 1}{r^n(r - 1)}$$

The present value of an annuity is the sum of the present values of the individual payments.

$$\frac{P}{A} = \sum_{j=1}^n \frac{1}{(1+i)^j}$$

Use the *power series* rule.

$$s = \sum_{j=1}^n \frac{1}{r^j} = \frac{r^n - 1}{r^n(r - 1)}$$

$$s = \frac{P}{A} \quad r = 1 + i$$

Therefore,

$$\frac{P}{A} = \frac{(1+i)^n - 1}{(1+i)^n(1+i-1)} = \frac{(1+i)^n - 1}{i(1+i)^n}$$

Calculating i and n

Given a conversion factor,

- Easy to calculate n if you know i .
- Easy to calculate i if you know n and F/P or P/F but not so easy for annuities.

Calculating i

Easy enough from F/P :

$$\frac{F}{P} = (1 + i)^n$$

$$\left(\frac{F}{P}\right)^{\frac{1}{n}} = 1 + i$$

$$i = \left(\frac{F}{P}\right)^{\frac{1}{n}} - 1$$

And because P/F is just the inverse of F/P :

$$i = \left(\frac{P}{F}\right)^{-\frac{1}{n}} - 1$$

Calculating n

Easy enough from F/P:

$$\frac{F}{P} = (1 + i)^n$$

$$\log\left(\frac{F}{P}\right) = n \log(1 + i)$$

$$n = \frac{\log\left(\frac{F}{P}\right)}{\log(1 + i)}$$

And because P/F is just the inverse of F/P:

$$n = \frac{-\log\left(\frac{F}{P}\right)}{\log(1 + i)}$$

Calculating n

And from F/A:

$$\frac{F}{A} = \frac{(1+i)^n - 1}{i}$$

$$i\left(\frac{F}{A}\right) = (1+i)^n - 1$$

$$i\left(\frac{F}{A}\right) + 1 = (1+i)^n$$

$$\log\left(i\left(\frac{F}{A}\right) + 1\right) = n \log(1+i)$$

$$n = \frac{\log\left(i\left(\frac{F}{A}\right) + 1\right)}{\log(1+i)}$$

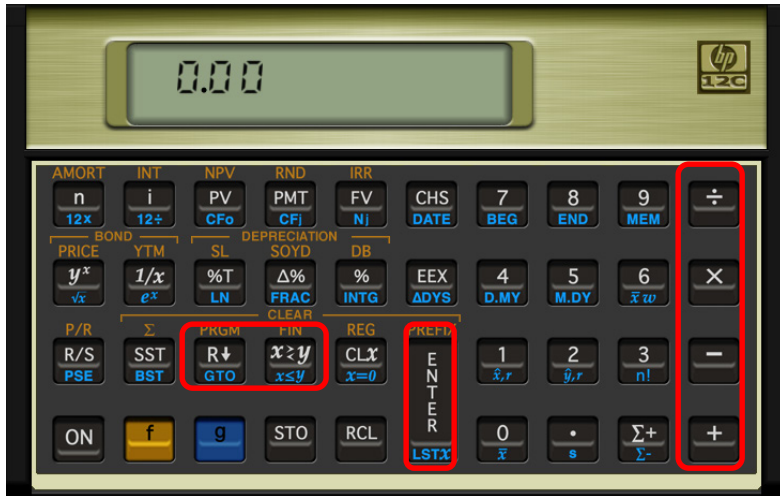
Not so easy to calculate i for an annuity.

$$\frac{F}{A} = \frac{(1+i)^n - 1}{i}$$

the workhorse HP-12c



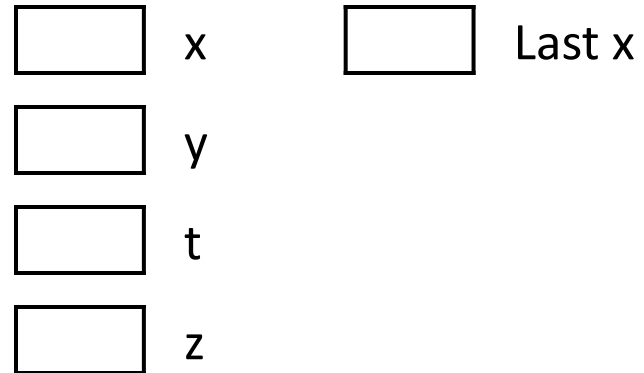
Reverse Polish



You enter the operands into the stack, then operate on the top elements.

Instead of $5 + 2 =$
you type 5 ENTER 2 +

Stack registers

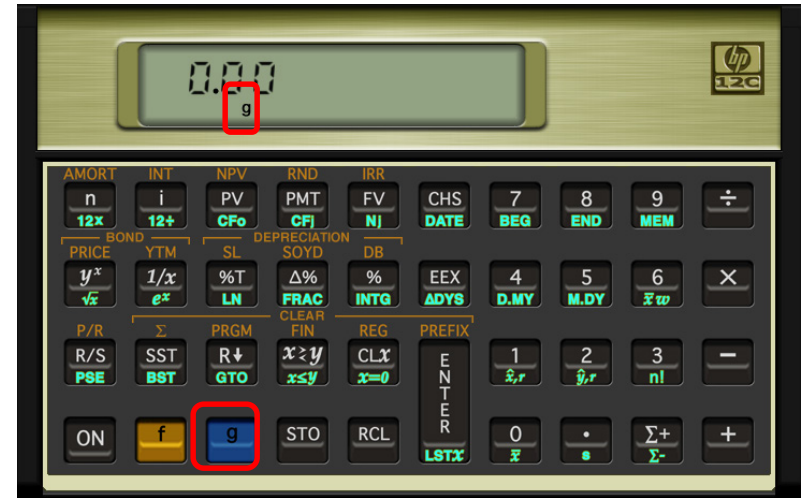


x is always displayed.
Whatever you type is in the x register.
Last value of x always kept in Last x.

Operations:

Push	ENTER
Rotate	R↓
Exchange	x↔y
Arithmetic	÷ - × +

Shift keys



f + 0 thru 9 sets number of decimal places.

f + . sets scientific notation.

(Unfortunately, they don't light up on the real thing.)

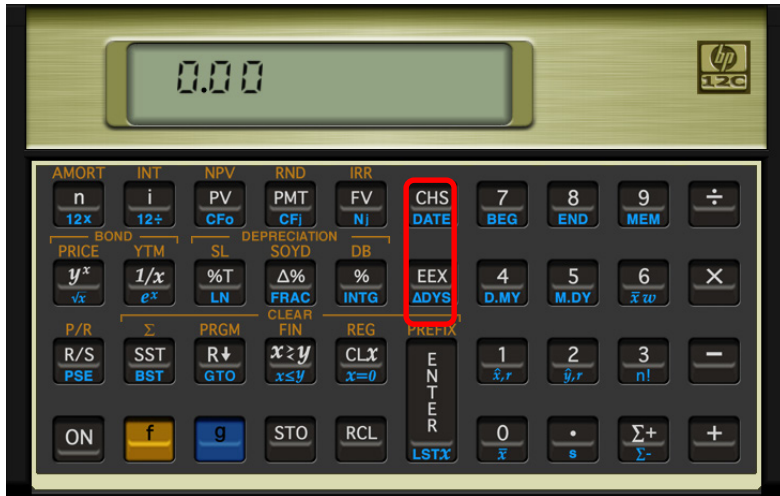
Clearing registers



f + FIN clears the financial registers.

f + REG clears the stack, Last x and the financial registers.

Entering numbers



EEX allows you to type scientific notation.

CHS changes the sign of an exponent or of a number *already* typed.

To get this

-5

2E6

-7E-3

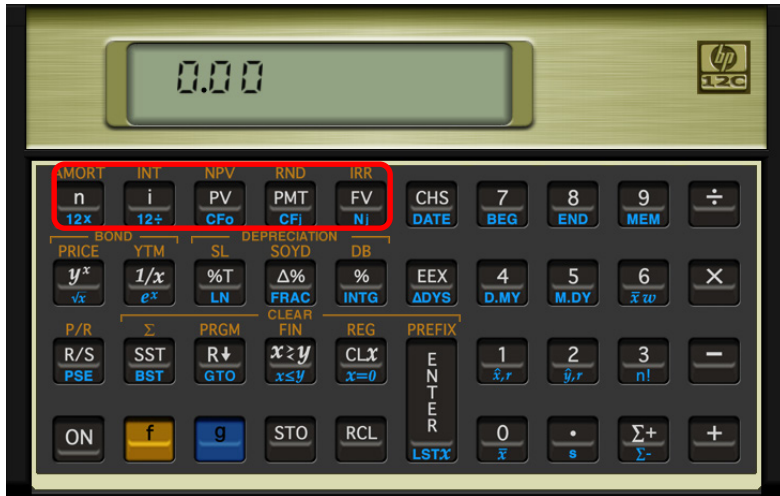
Type this

5 CHS

2 EEX 6

7 CHS EEX 3 CHS

Financial registers



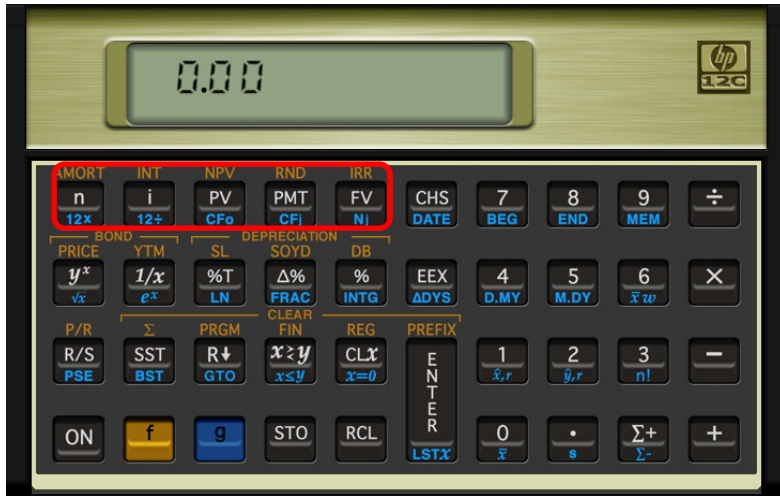
Financial registers

<input type="text"/>	n	<input type="text"/>	N0	<input type="text"/>	CF0 (R0)
<input type="text"/>	i	<input type="text"/>	N1	<input type="text"/>	CF1 (R1)
<input type="text"/>	PV	<input type="text"/>	N2	<input type="text"/>	CF2 (R2)
<input type="text"/>	PMT	<input type="text"/>	N3	<input type="text"/>	CF3 (R3)
<input type="text"/>	FV	<input type="text"/>	N4	<input type="text"/>	CF4 (R4)
		:		:	
		<input type="text"/>	N20	<input type="text"/>	CF20 (R.9)

n = number of periods
 i = interest rate as a %
 PV = present value
 PMT = annuity amount
 FV = future value

N1 thru N20 and CF0 thru CF20 are for irregular cash flows, where CF_i is repeated N_i times.

Financial registers



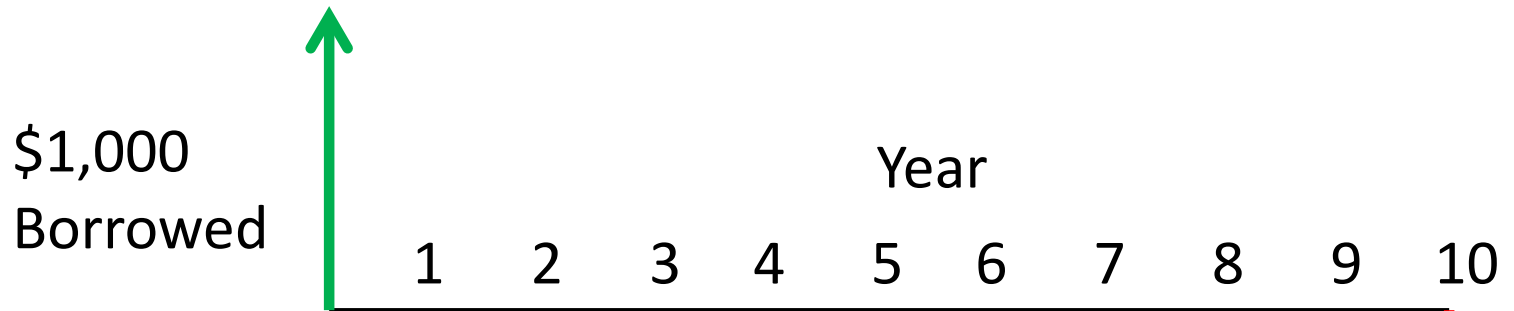
Financial registers

<input type="text"/>	n	<input type="text"/>	N0	<input type="text"/>	CF0 (R0)
<input type="text"/>	i	<input type="text"/>	N1	<input type="text"/>	CF1 (R1)
<input type="text"/>	PV	<input type="text"/>	N2	<input type="text"/>	CF2 (R2)
<input type="text"/>	PMT	<input type="text"/>	N3	<input type="text"/>	CF3 (R3)
<input type="text"/>	FV	<input type="text"/>	N4	<input type="text"/>	CF4 (R4)
		:		:	
		<input type="text"/>	N20	<input type="text"/>	CF20 (R.9)

Typing a number and pressing n, i, PV, PMT or FV *stores* that value.

Pressing n, i, PV, PMT or FV alone *calculates* the value based on what's in the other registers.

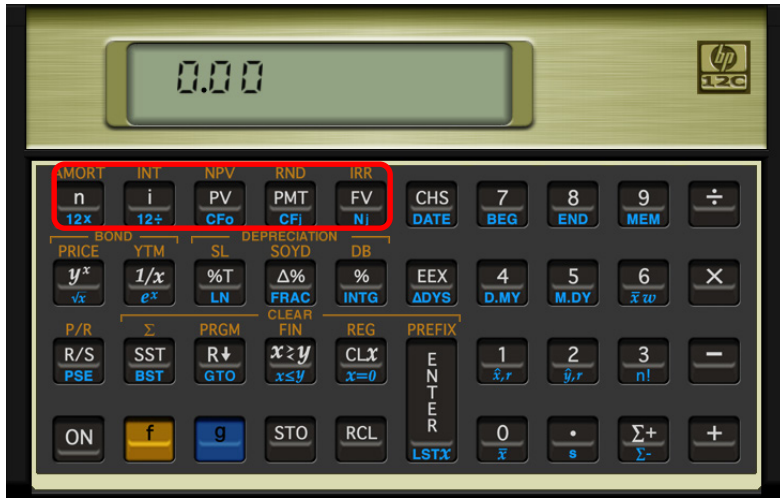
Example: \$1000 borrowed for 10 years at 6% per year, compounded annually.



$$\frac{F}{P} = (1 + i)^n = (1 + .06)^{10} = 1.790848$$

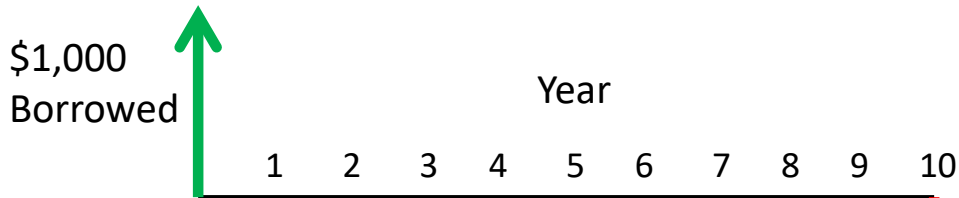
$$(\$1,000) \left(\frac{F}{P} \right) = \$1,790.85$$

Example: \$1000 borrowed for 10 years at 6% per year.



Financial registers

10	n		N0		CF0 (R0)
6	i		N1		CF1 (R1)
1000	PV		N2		CF2 (R2)
0	PMT		N3		CF3 (R3)
?	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)



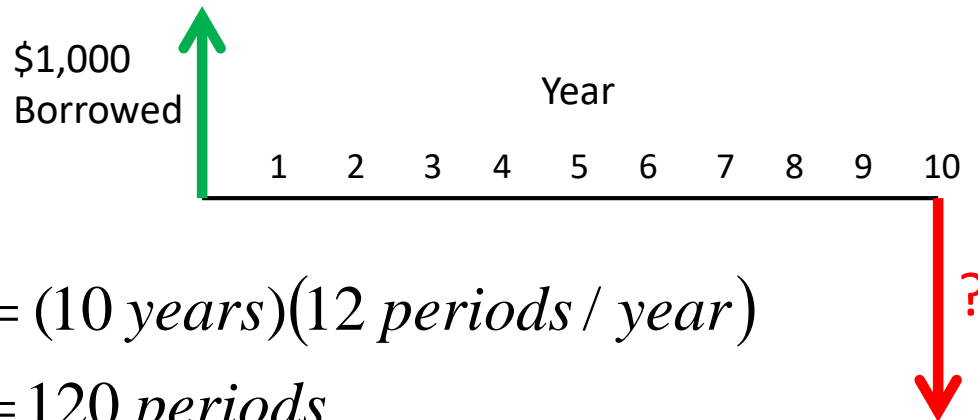
The result from the formula was \$1,790.85.
What does the HP-12c say?

Procedure:

1. Clear the registers.
2. Enter n, i and PV.
3. Press FV.

But interest rates on loans in the US are stated as APRs.

Example: \$1000 borrowed for 10 years
at 6% **APR**



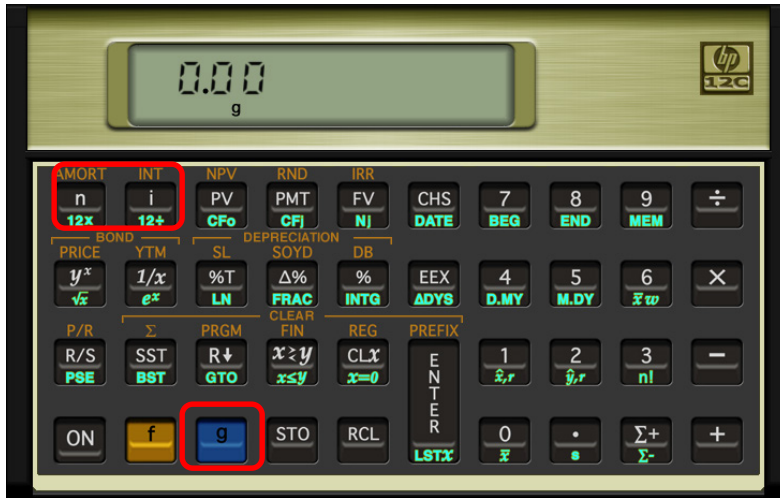
$$n = (10 \text{ years})(12 \text{ periods / year})$$
$$= 120 \text{ periods}$$

$$i = \frac{.06}{12} = .005$$

$$\frac{F}{P} = (1 + i)^n = (1 + .005)^{120} = 1.819397$$

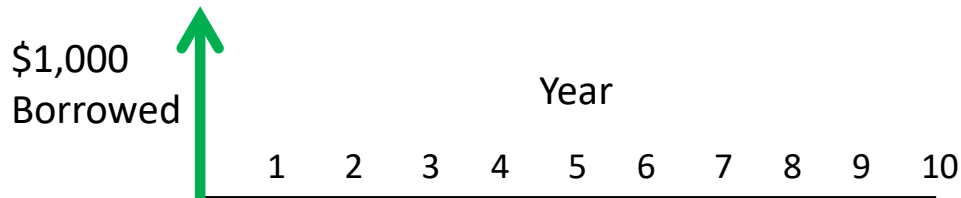
$$(\$1,000) \left(\frac{F}{P} \right) = \$1,819.40$$

Example: \$1000 borrowed for 10 years at 6% APR.



Financial registers

120	n		N0		CF0 (R0)
.5	i		N1		CF1 (R1)
1000	PV		N2		CF2 (R2)
0	PMT		N3		CF3 (R3)
?	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)



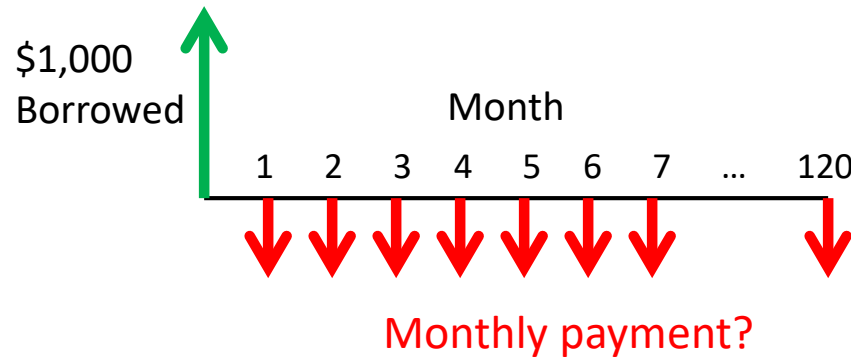
The result from the formula was \$1,819.40.
What does the HP-12c say?

Procedure:

1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PV.
4. Press FV.

And most loans in the US
require monthly payments.

Example: \$1000 borrowed for 10 years
at 6% APR with monthly payments



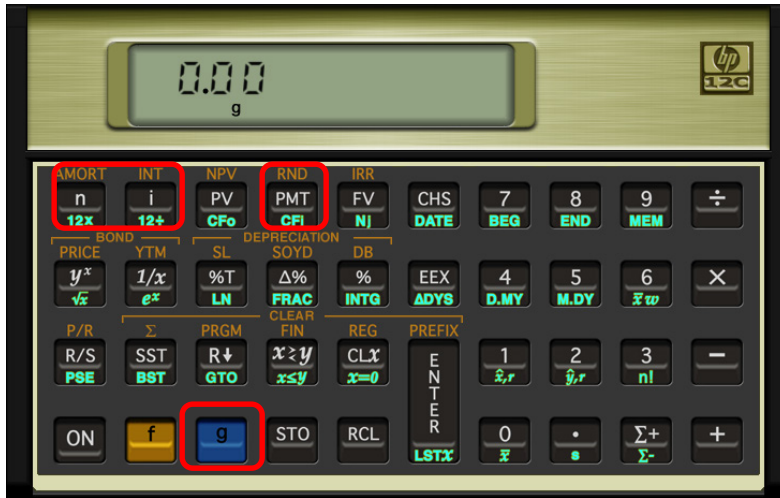
$$n = 120$$

$$i = .005$$

$$\frac{A}{P} = \frac{i(1+i)^n}{(1+i)^n - 1} = \frac{(.005)(1+.005)^{120}}{(1+.005)^{120} - 1} = .011102$$

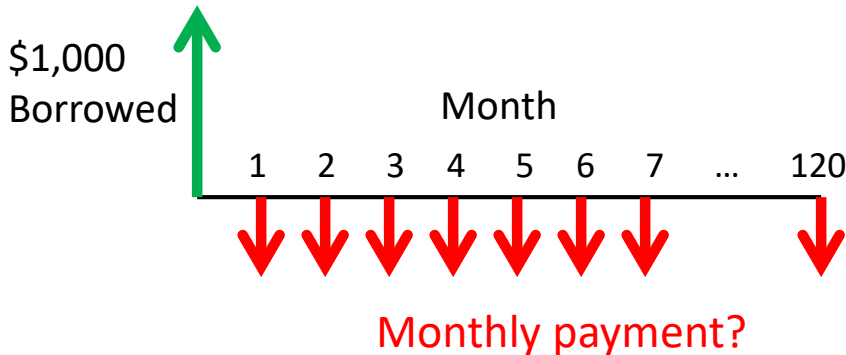
$$(\$1000) \left(\frac{A}{P} \right) = \$11.10$$

Example: \$1000 borrowed for 10 years at 6% APR with monthly payments.



Financial registers

120	n		N0		CF0 (R0)
.5	i		N1		CF1 (R1)
1000	PV		N2		CF2 (R2)
?	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)

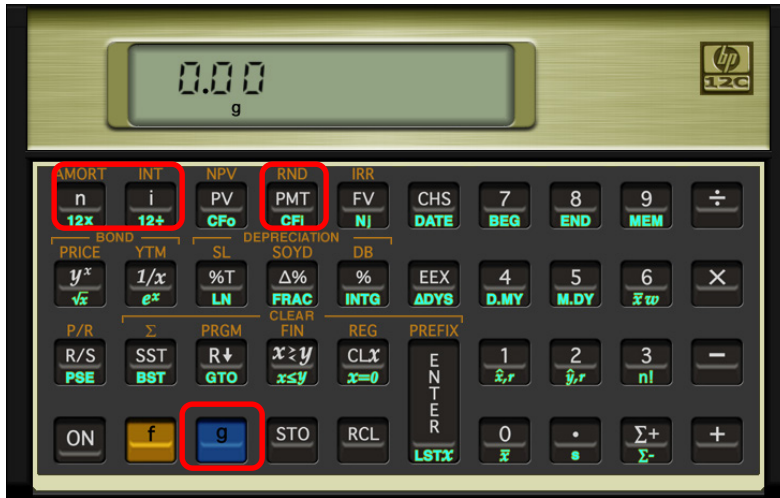


The result from the formula was \$11.10.
What does the HP-12c say?

Procedure:

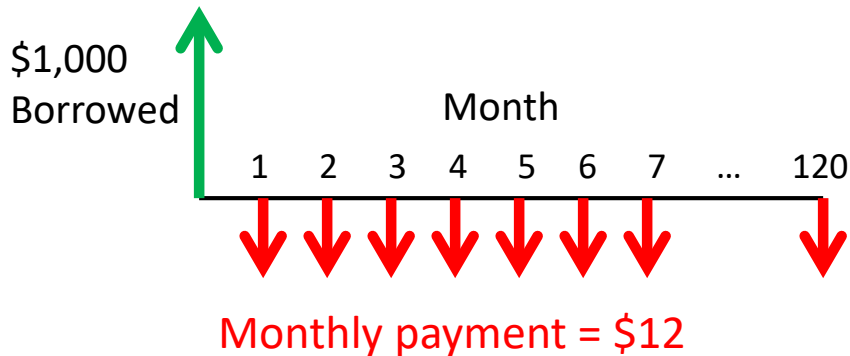
1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PV.
4. Press PMT.

Example: \$1000 borrowed for 10 years with monthly payments of \$12. What's the APR?



Financial registers

120	n		N0		CF0 (R0)
?	i		N1		CF1 (R1)
1000	PV		N2		CF2 (R2)
-12	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)



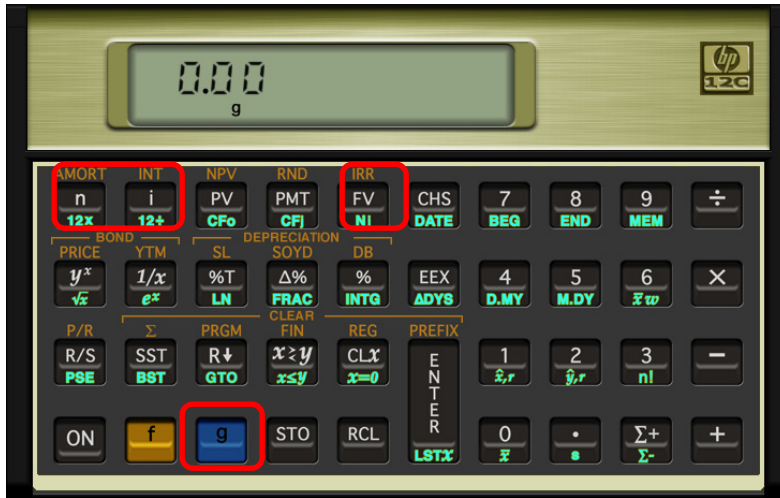
Procedure:

1. Clear the registers.
2. Enter n using the 12x function.
3. Enter PV and PMT
4. Press i.
5. Multiply times 12.

Exercise

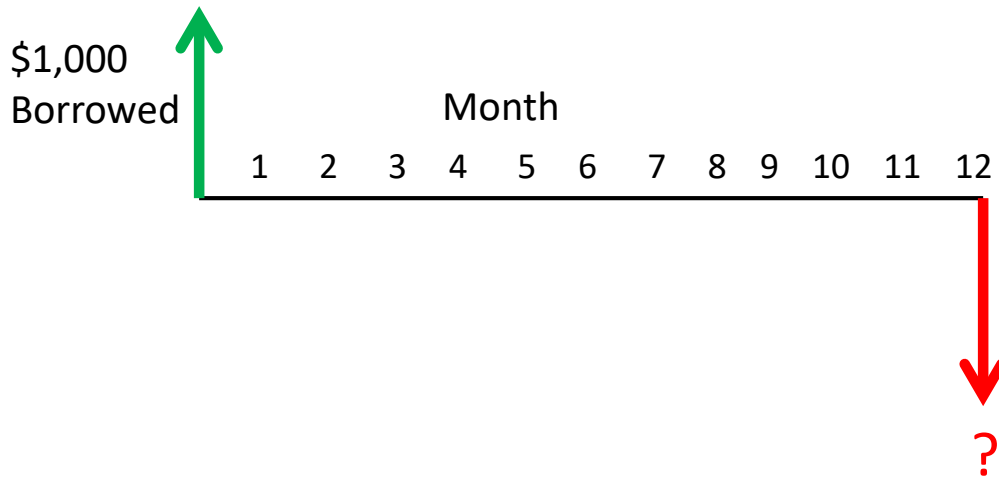
You owe \$1000 at 29.99% APR. If you make no payments, what will you owe a year from now?

\$1000 borrowed for 1 year at 29.99% APR



Financial registers

12	n		N0		CF0 (R0)
2.4992	i		N1		CF1 (R1)
1000	PV		N2		CF2 (R2)
0	PMT		N3		CF3 (R3)
?	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)



Procedure:

1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PV.
4. Press FV.

Exercise

Ten years ago, Acme Corporation financed a new warehouse in part with a mortgage for \$500K for 20 years at 5%.

What's their monthly mortgage payment?

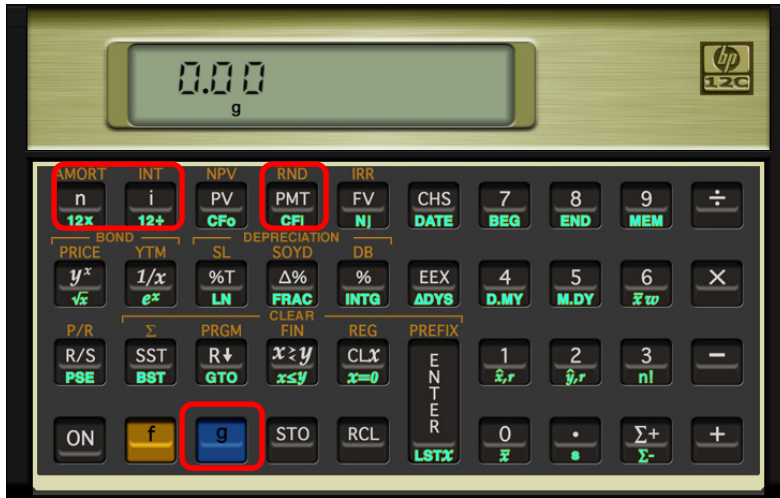
Exercise

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What's their monthly mortgage payment?

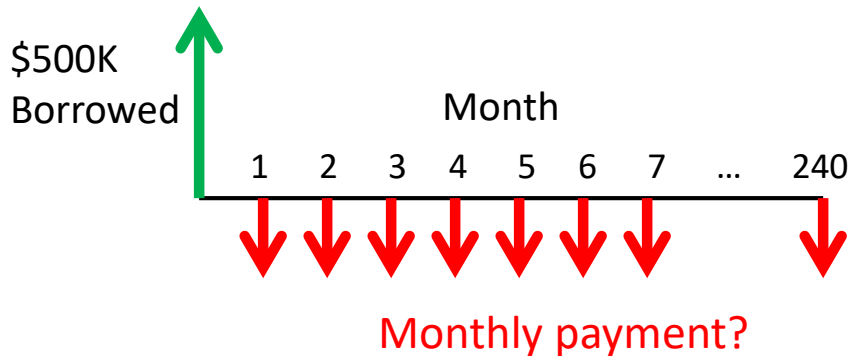
Hint: Interest rates on loans in the US are stated as APRs.

\$500K borrowed for 20 years at 5% APR with monthly payments.



Financial registers

240	n		N0		CF0 (R0)
.41667	i		N1		CF1 (R1)
500000	PV		N2		CF2 (R2)
?	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)



Should be \$3,299.78/month.

Procedure:

1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PV.
4. Press PMT.

Exercise

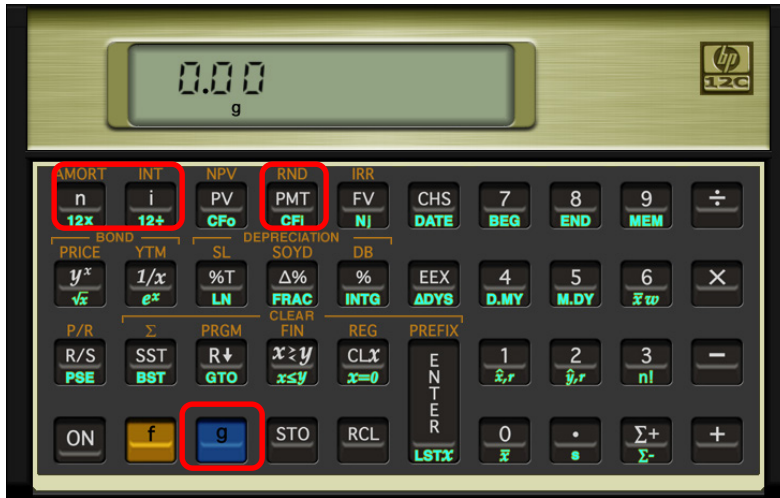
Acme has just made their 120th payment on the mortgage. What is the remaining principal on the loan?

Exercise

Acme has just made their 120th payment on the mortgage. What is the remaining principal on the loan?

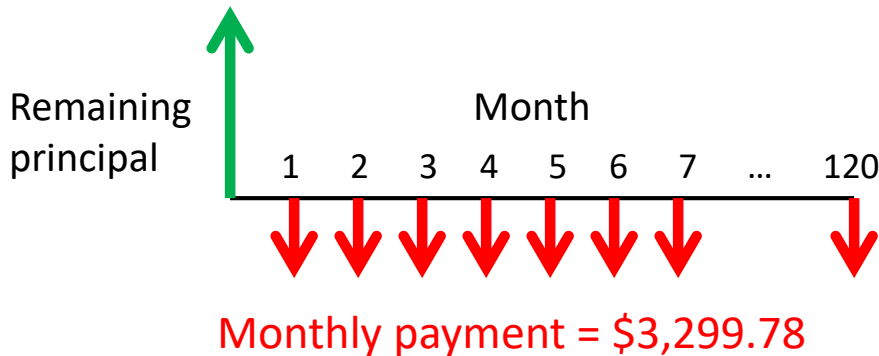
Hint: Acme has 10 years = 120 payments left and the interest rate is unchanged.

Principal remaining after 120th payment



Financial registers

120	n		N0		CF0 (R0)
.41667	i		N1		CF1 (R1)
?	PV		N2		CF2 (R2)
-3299.78	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)



Procedure:

1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PMT.
4. Press PV.

Remaining principal should be \$311,107.59.

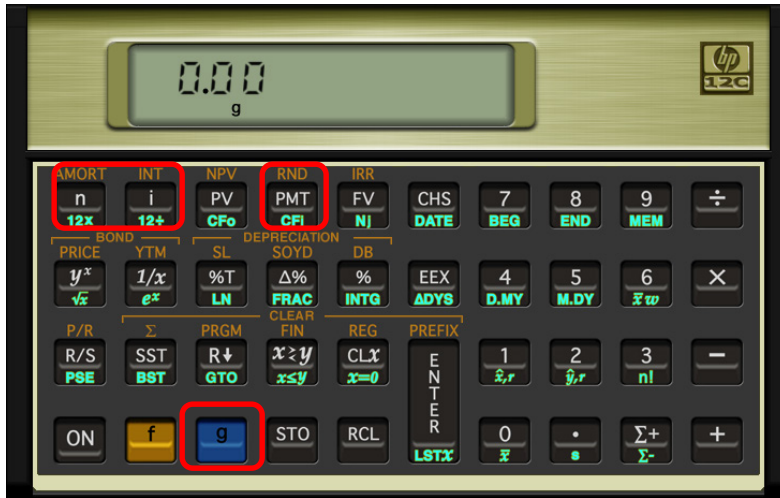
Exercise

Ten years ago, Acme Corporation financed a new warehouse in part with a mortgage for \$500K for 20 years at 5%.

A year from now, Acme will have just made their 132nd payment. Between now and then, how much interest will Acme have paid?

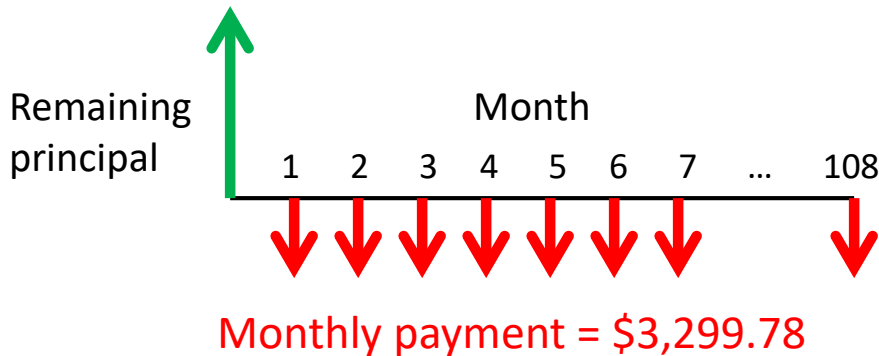
After the 132nd payment, Acme will have
 $240 - 132 = 108$ payments left.

Principal remaining after 132nd payment



Financial registers

108	n		N0		CF0 (R0)
.41667	i		N1		CF1 (R1)
?	PV		N2		CF2 (R2)
-3299.78	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)



Procedure:

1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PMT.
4. Press PV.

Remaining principal should be \$286,506.94.

After 132nd payment

Remaining principal = \$286,506.94

Amount of principal paid off in the year =
Remaining principal after 120th payment –
Remaining principal after 132nd payment
= 311,107.59 – 286,506.94 = \$24,600.65

Total of payments = 12 * 3299.78 = \$39,597.36

Interest paid = Total payments – Principal paid off
= 39,597.36 – 24,600.65 = \$14,996.69

Amortization

Amortize

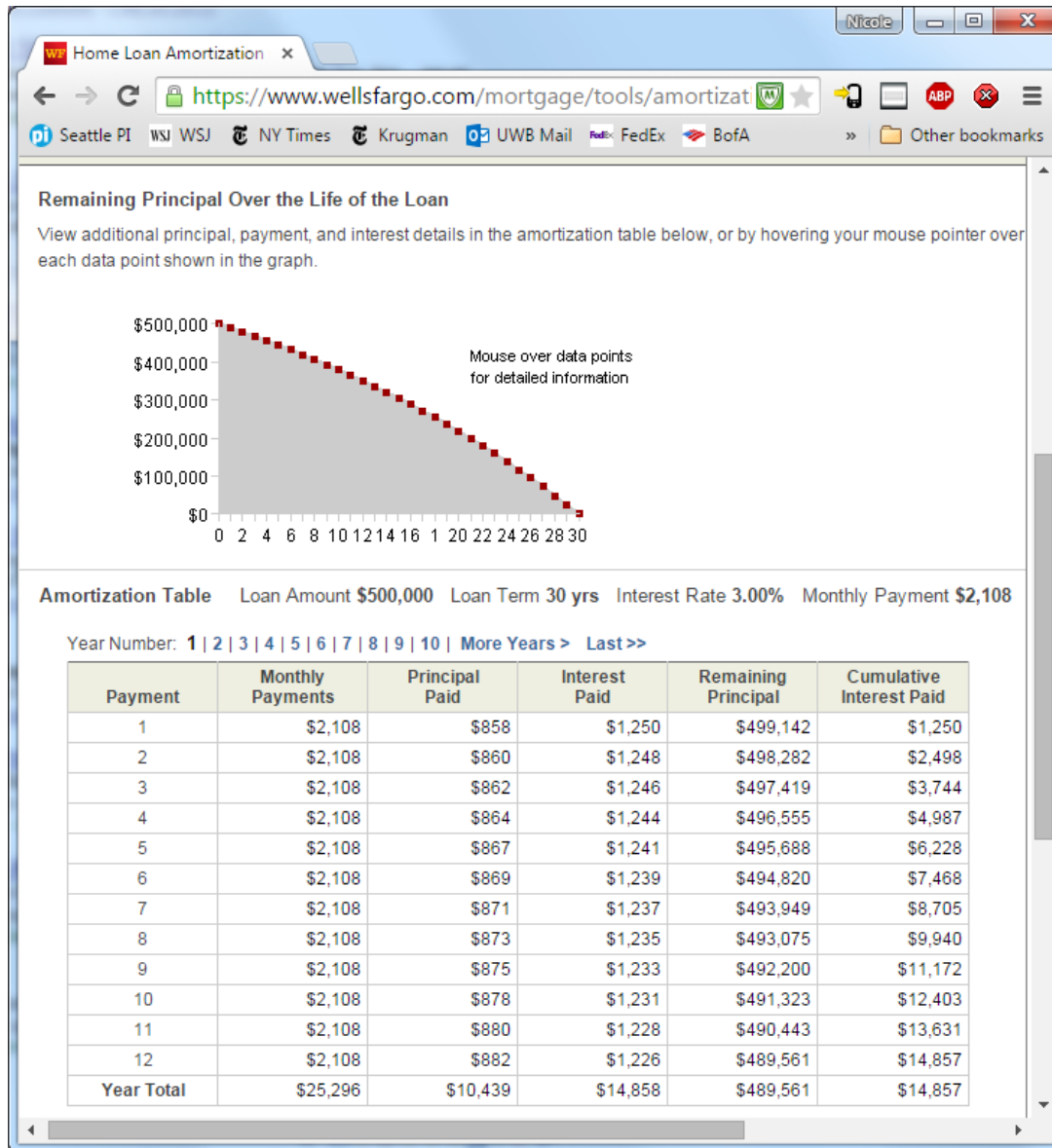
A term used in lending that means each payment will be allocated to separate principal and interest amounts.

The allocation is calculated to the *nearest unit, usually a penny*.

When the remaining principal goes to zero, the loan is *fully amortized*.

Most commonly used in mortgage loans.

Typically presented as a table called an *amortization schedule*.



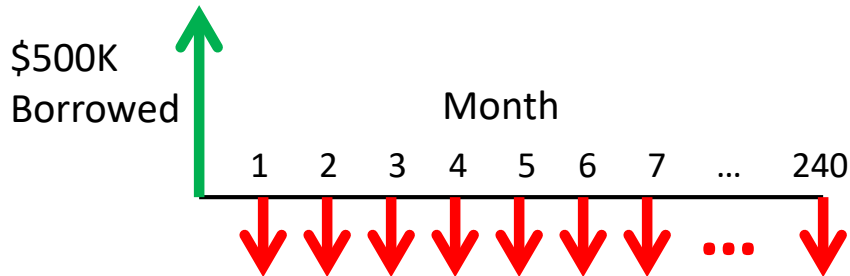
<https://www.wellsfargo.com/mortgage/tools/amortization/>

Amortization function



Financial registers

0	n		N0		CF0 (R0)
.41667	i		N1		CF1 (R1)
500000	PV		N2		CF2 (R2)
-3299.78	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)



How much interest and principal has been paid by the 120th payment?

Procedure:

1. Clear the registers.
2. Enter PV, PMT, n and i.
3. Enter number of payments to amortize.
4. Press AMORT.
5. x contains interest paid
6. y contains principal paid
7. RCL PV to get principal remaining
8. RCL n to get number of payments amortized so far.

Principal remaining after 120th payment

Slight difference between:

1. PV of remaining payments = \$311,107.59
2. Amortized remaining principal = \$311,107.41

Difference is because under amortization, amounts allocated to principal versus interest are calculated only to the *nearest penny* (or whatever digits of precision you've set via f-key.)

(A bank will care about this difference, I don't.)

Creating an amortization schedule

Because:

1. Principal paid is subtracted from PV.
2. Number of payments amortized added to n .

The amortization function can be used to be used to amortize successive payments.

1. PV always contains remaining principal.
2. n always contains number of payment amortized so far.
3. Works with loans that never fully amortize, e.g., because of a balloon payment at the end.

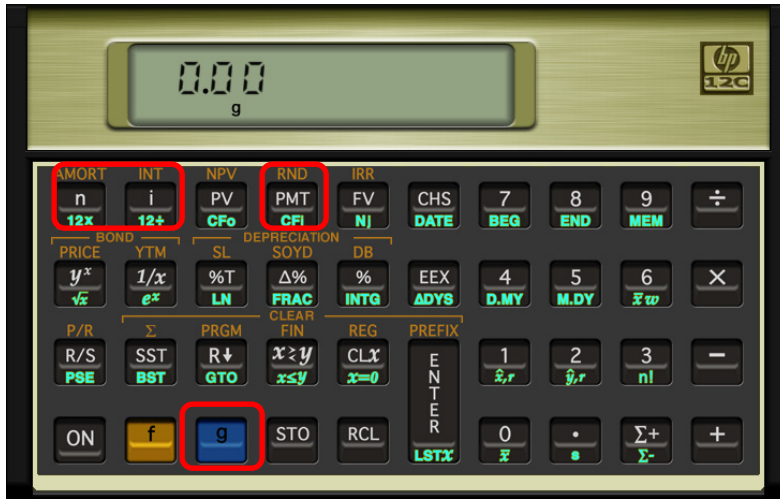
Exercise

You've just bought a home with \$400K, 30-year mortgage at 3% APR.

1. What does the cash flow diagram look like?
2. What is your monthly payment?
3. Fill in this table for the first 3 years:

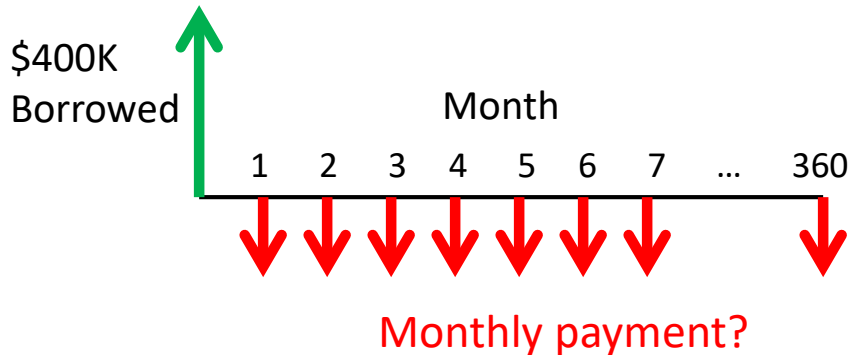
Year	Beginning principal	Principal paid	Interest paid	Ending principal
1	400,000			
2				
3				
Total paid				

\$400K borrowed for 30 years at 3% APR with monthly payments.



Financial registers

360	n		N0		CF0 (R0)
.25	i		N1		CF1 (R1)
400000	PV		N2		CF2 (R2)
?	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)



Should be \$1,686.42/month.

Procedure:

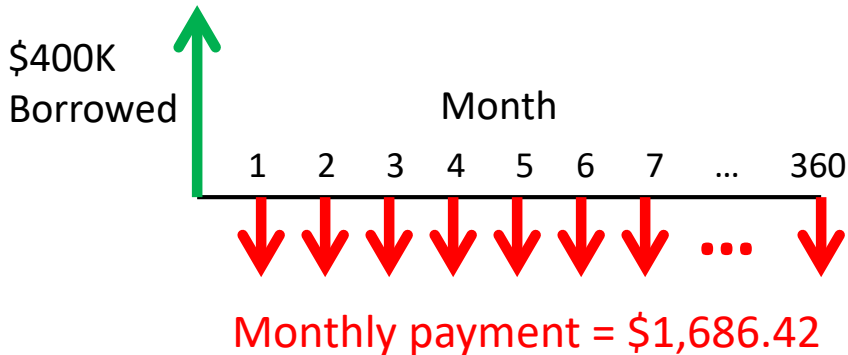
1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PV.
4. Press PMT.

Amortize first year



Financial registers

0	n		N0		CF0 (R0)
.25	i		N1		CF1 (R1)
400000	PV		N2		CF2 (R2)
-1686.42	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)



Interest paid = \$11,885.80
 Principal paid = \$8,351.24
 Principal remaining = \$391,648.76

Procedure:

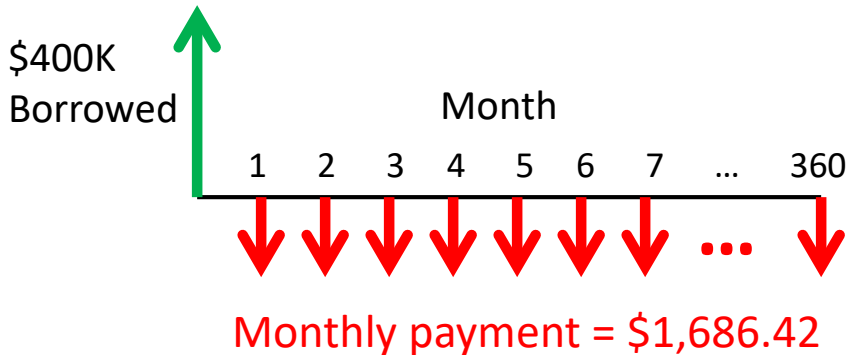
1. Set n = 0.
2. Enter 12 payments to amortize.
3. Press AMORT.
4. x contains interest paid
5. y contains principal paid
6. RCL PV to get principal remaining

Amortize second year



Financial registers

12	n		N0		CF0 (R0)
.25	i		N1		CF1 (R1)
391648.76	PV		N2		CF2 (R2)
-1686.42	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)



Interest paid = \$11,631.78
 Principal paid = \$8,605.26
 Principal remaining = \$383,043.50

Procedure:

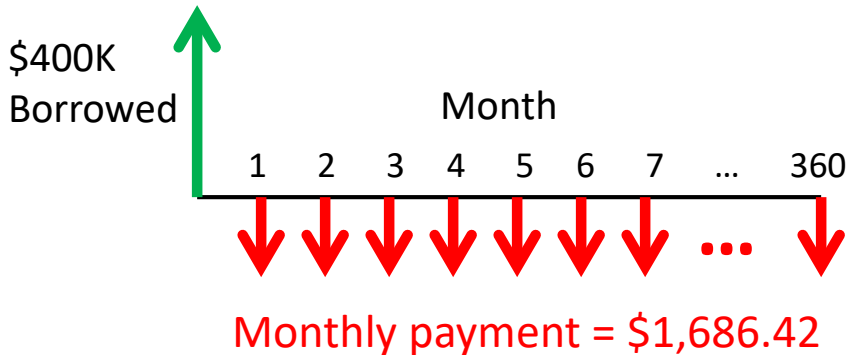
1. Enter 12 payments to amortize.
2. Press AMORT.
3. x contains interest paid
4. y contains principal paid
5. RCL PV to get principal remaining

Amortize third year



Financial registers

24	n		N0		CF0 (R0)
.41667	i		N1		CF1 (R1)
383043.50	PV		N2		CF2 (R2)
-1686.42	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)



Interest paid = \$11,370.04
 Principal paid = \$8,867.00
 Principal remaining = \$374,176.50

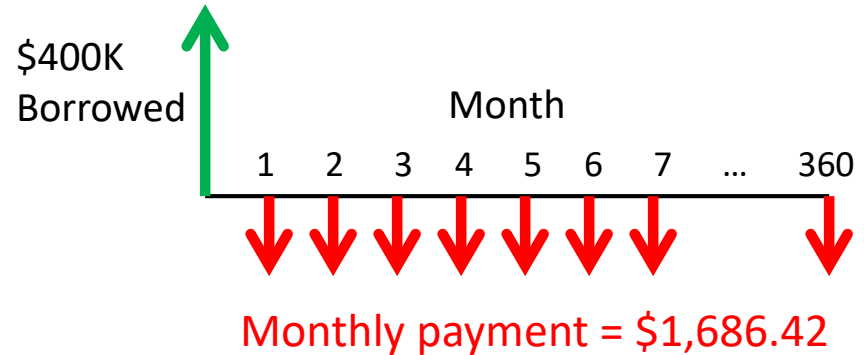
Procedure:

1. Enter 12 payments to amortize.
2. Press AMORT.
3. x contains interest paid
4. y contains principal paid
5. RCL PV to get principal remaining

Exercise

You've just bought a home with \$400K, 30-year mortgage at 3% APR.

1. What does the cash flow diagram look like?
2. What is your monthly payment?
\$1,686.42
3. Fill in this table for the first 3 years:



Year	Beginning principal	Principal paid	Interest paid	Ending principal
1	400,000	8,351.24	11,885.80	391,648.76
2	391,648.76	8,605.26	11,631.78	383,043.50
3	383,043.50	8,867.00	11,370.04	374,176.50
Total paid		25,823.50	34,887.62	

Escrow

Usually when you get a mortgage, your payment will be more than principal + interest.

Usually the bank will want you to *escrow* fire insurance and property tax payments.

You pay an amount each month estimated to cover insurance and tax.

The mortgage company then makes those payments.

This way, the mortgage company knows for sure that the payments got made.

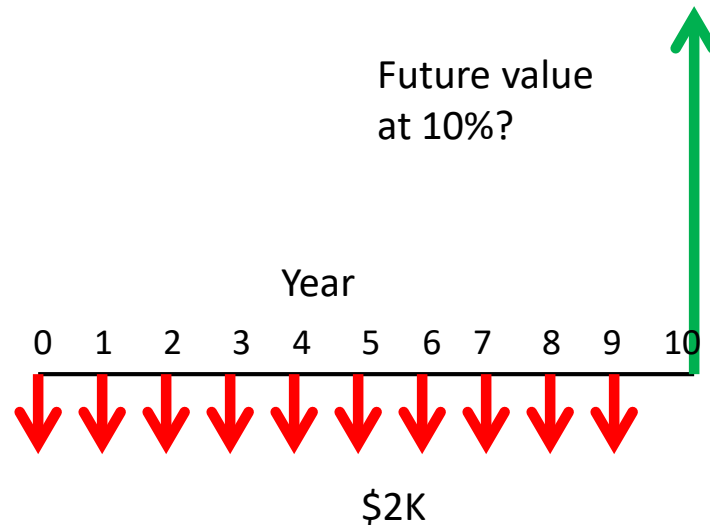
Investments

Interest rates on investments are different than interest rates on loans.

Loans are stated as APRs and are compounded monthly.

Investors normally use annual compounding when evaluating an investment.

Sinking funds

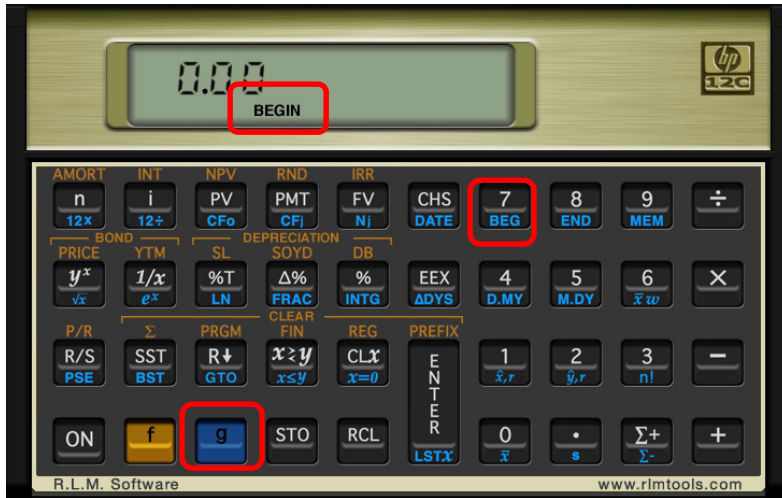


Annuities that you pay into to get a future return are call sinking funds.

An example would be a regular savings plan.

Annuity payments are at the **beginning** of the period, not the end.

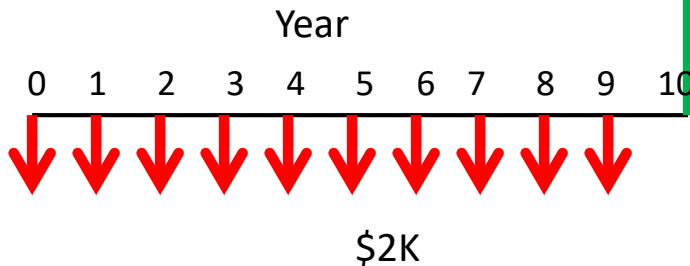
Sinking fund at 10%



Financial registers

10	n		N0		CF0 (R0)
10	i		N1		CF1 (R1)
0	PV		N2		CF2 (R2)
-2K	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		:		:	
			N20		CF20 (R.9)

Future value at 10%?
Should be \$35,062.33



Procedure:

1. Clear the registers.
2. Set in BEGIN mode.
3. Enter n and i.
4. Press FV.

Net present value (NPV)

Net sum of all the discounted inflows and outflows.

$$NPV = \sum_{j=0}^n (CF_j) \left(\frac{P}{F} \Big|_{i,j} \right)$$

Could be either positive or negative.

At the ***internal rate of return (IRR)***, the NPV is zero.