

## Common FDPs #1

### Halves

Fraction	Decimal	Percent
1/1		
1/2		
3/2		

### Fourths

Fraction	Decimal	Percent
1/4		
3/4		
5/4		
7/4		

### Eighths

Fraction	Decimal	Percent
1/8		
3/8		
5/8		
7/8		

### Fifths

Fraction	Decimal	Percent
1/5		
2/5		
3/5		
4/5		

### Tenths

Fraction	Decimal	Percent
1/10		
3/10		
7/10		
9/10		

### Halves

Fraction	Decimal	Percent
1/1	1	100%
1/2	0.5	50%
3/2	1.5	150%

### Fourths

Fraction	Decimal	Percent
1/4	0.25	25%
3/4	0.75	75%
5/4	1.25	125%
7/4	1.75	175%

### Eighths

Fraction	Decimal	Percent
1/8	0.125	12.5%
3/8	0.375	37.5%
5/8	0.625	62.5%
7/8	0.875	87.5%

### Fifths

Fraction	Decimal	Percent
1/5	0.2	20%
2/5	0.4	40%
3/5	0.6	60%
4/5	0.8	80%

### Tenths

Fraction	Decimal	Percent
1/10	0.1	10%
3/10	0.3	30%
7/10	0.7	70%
9/10	0.9	90%

## Common FDPs #1

### Halves

Fraction	Decimal	Percent
	1	
	0.5	
	1.5	

### Fourths

Fraction	Decimal	Percent
	0.25	
	0.75	
	1.25	
	1.75	

### Eighths

Fraction	Decimal	Percent
	0.125	
	0.375	
	0.625	
	0.875	

### Fifths

Fraction	Decimal	Percent
	0.2	
	0.4	
	0.6	
	0.8	

### Tenths

Fraction	Decimal	Percent
	0.1	
	0.3	
	0.7	
	0.9	

### Halves

Fraction	Decimal	Percent
1/1	1	100%
1/2	0.5	50%
3/2	1.5	150%

### Fourths

Fraction	Decimal	Percent
1/4	0.25	25%
3/4	0.75	75%
5/4	1.25	125%
7/4	1.75	175%

### Eighths

Fraction	Decimal	Percent
1/8	0.125	12.5%
3/8	0.375	37.5%
5/8	0.625	62.5%
7/8	0.875	87.5%

### Fifths

Fraction	Decimal	Percent
1/5	0.2	20%
2/5	0.4	40%
3/5	0.6	60%
4/5	0.8	80%

### Tenths

Fraction	Decimal	Percent
1/10	0.1	10%
3/10	0.3	30%
7/10	0.7	70%
9/10	0.9	90%

## Common FDPs #1

### Halves

Fraction	Decimal	Percent
		100%
		50%
		150%

### Fourths

Fraction	Decimal	Percent
		25%
		75%
		125%
		175%

### Eighths

Fraction	Decimal	Percent
		12.5%
		37.5%
		62.5%
		87.5%

### Fifths

Fraction	Decimal	Percent
		20%
		40%
		60%
		80%

### Tenths

Fraction	Decimal	Percent
		10%
		30%
		70%
		90%

### Halves

Fraction	Decimal	Percent
1/1	1	100%
1/2	0.5	50%
3/2	1.5	150%

### Fourths

Fraction	Decimal	Percent
1/4	0.25	25%
3/4	0.75	75%
5/4	1.25	125%
7/4	1.75	175%

### Eighths

Fraction	Decimal	Percent
1/8	0.125	12.5%
3/8	0.375	37.5%
5/8	0.625	62.5%
7/8	0.875	87.5%

### Fifths

Fraction	Decimal	Percent
1/5	0.2	20%
2/5	0.4	40%
3/5	0.6	60%
4/5	0.8	80%

### Tenths

Fraction	Decimal	Percent
1/10	0.1	10%
3/10	0.3	30%
7/10	0.7	70%
9/10	0.9	90%

## Common FDPs #2

### Thirds

Fraction	Decimal	Percent
1/3		
2/3		
4/3		

### Sixths

Fraction	Decimal	Percent
1/6		
5/6		

### Ninths

Fraction	Decimal	Percent
1/9		
2/9		
4/9		
5/9		
7/9		
8/9		

### Twelvths

Fraction	Decimal	Percent
1/12		
5/12		
7/12		
11/12		

### Thirds

Fraction	Decimal	Percent
1/3	0.333	33.3%
2/3	0.666	66.7%
4/3	1.33	133%

### Sixths

Fraction	Decimal	Percent
1/6	0.167	16.7%
5/6	0.833	83.3%

### Ninths

Fraction	Decimal	Percent
1/9	0.11	11.1%
2/9	0.22	22%
4/9	0.44	44%
5/9	0.56	56%
7/9	0.78	78%
8/9	0.89	89%

### Twelvths

Fraction	Decimal	Percent
1/12	0.08	8.3%
5/12	0.42	42%
7/12	0.58	58%
11/12	0.92	92%

## Common FDPs #2

### Thirds

Fraction	Decimal	Percent
	0.333	
	0.666	
	1.33	

### Sixths

Fraction	Decimal	Percent
	0.167	
	0.833	

### Ninths

Fraction	Decimal	Percent
	0.11	
	0.22	
	0.44	
	0.56	
	0.78	
	0.89	

### Twelvths

Fraction	Decimal	Percent
	0.08	
	0.42	
	0.58	
	0.92	

### Thirds

Fraction	Decimal	Percent
1/3	0.333	33.3%
2/3	0.666	66.7%
4/3	1.33	133%

### Sixths

Fraction	Decimal	Percent
1/6	0.167	16.7%
5/6	0.833	83.3%

### Ninths

Fraction	Decimal	Percent
1/9	0.11	11.1%
2/9	0.22	22%
4/9	0.44	44%
5/9	0.56	56%
7/9	0.78	78%
8/9	0.89	89%

### Twelvths

Fraction	Decimal	Percent
1/12	0.08	8.3%
5/12	0.42	42%
7/12	0.58	58%
11/12	0.92	92%

## Common FDPs #2

### Thirds

Fraction	Decimal	Percent
		33.3%
		66.7%
		133%

### Sixths

Fraction	Decimal	Percent
		16.7%
		83.3%

### Ninths

Fraction	Decimal	Percent
		11.1%
		22%
		44%
		56%
		78%
		89%

### Twelvths

Fraction	Decimal	Percent
		8.3%
		42%
		58%
		92%

### Thirds

Fraction	Decimal	Percent
1/3	0.333	33.3%
2/3	0.666	66.7%
4/3	1.33	133%

### Sixths

Fraction	Decimal	Percent
1/6	0.167	16.7%
5/6	0.833	83.3%

### Ninths

Fraction	Decimal	Percent
1/9	0.11	11.1%
2/9	0.22	22%
4/9	0.44	44%
5/9	0.56	56%
7/9	0.78	78%
8/9	0.89	89%

### Twelvths

Fraction	Decimal	Percent
1/12	0.08	8.3%
5/12	0.42	42%
7/12	0.58	58%
11/12	0.92	92%

### Common FDPs #3

#### Sevenths

Fraction	Decimal	Percent
1/7		
2/7		
3/7		
4/7		
5/7		
6/7		

#### Elevenths

Fraction	Decimal	Percent
1/11		
2/11		
3/11		
4/11		
5/11		
6/11		
7/11		
8/11		
9/11		
10/11		

#### Thirteenths

Fraction	Decimal	Percent
1/13		
2/13		
3/13		
4/13		
5/13		
6/13		
7/13		
8/13		
9/13		
10/13		
11/13		
12/13		

#### Sevenths

Fraction	Decimal	Percent
1/7	0.14	14.3%
2/7	0.29	29%
3/7	0.43	43%
4/7	0.57	57%
5/7	0.71	71%
6/7	0.86	86%

#### Elevenths

Fraction	Decimal	Percent
1/11	0.09	9.09%
2/11	0.18	18%
3/11	0.27	27%
4/11	0.36	36%
5/11	0.45	45%
6/11	0.55	55%
7/11	0.64	64%
8/11	0.73	73%
9/11	0.82	82%
10/11	0.91	91%

#### Thirteenths

Fraction	Decimal	Percent
1/13	0.08	7.69%
2/13	0.15	15%
3/13	0.23	23%
4/13	0.31	31%
5/13	0.38	38%
6/13	0.46	46%
7/13	0.54	54%
8/13	0.62	62%
9/13	0.69	69%
10/13	0.77	77%
11/13	0.85	85%
12/13	0.92	92%

### Common FDPs #3

#### Sevenths

Fraction	Decimal	Percent
	0.14	
	0.29	
	0.43	
	0.57	
	0.71	
	0.86	

#### Elevenths

Fraction	Decimal	Percent
	0.09	
	0.18	
	0.27	
	0.36	
	0.45	
	0.55	
	0.64	
	0.73	
	0.82	
	0.91	

#### Thirteenths

Fraction	Decimal	Percent
	0.08	
	0.15	
	0.23	
	0.31	
	0.38	
	0.46	
	0.54	
	0.62	
	0.69	
	0.77	
	0.85	
	0.92	

#### Sevenths

Fraction	Decimal	Percent
1/7	0.14	14.3%
2/7	0.29	29%
3/7	0.43	43%
4/7	0.57	57%
5/7	0.71	71%
6/7	0.86	86%

#### Elevenths

Fraction	Decimal	Percent
1/11	0.09	9.09%
2/11	0.18	18%
3/11	0.27	27%
4/11	0.36	36%
5/11	0.45	45%
6/11	0.55	55%
7/11	0.64	64%
8/11	0.73	73%
9/11	0.82	82%
10/11	0.91	91%

#### Thirteenths

Fraction	Decimal	Percent
1/13	0.08	7.69%
2/13	0.15	15%
3/13	0.23	23%
4/13	0.31	31%
5/13	0.38	38%
6/13	0.46	46%
7/13	0.54	54%
8/13	0.62	62%
9/13	0.69	69%
10/13	0.77	77%
11/13	0.85	85%
12/13	0.92	92%

### Common FDPs #3

#### Sevenths

Fraction	Decimal	Percent
		14.3%
		29%
		43%
		57%
		71%
		86%

#### Elevenths

Fraction	Decimal	Percent
		9.09%
		18%
		27%
		36%
		45%
		55%
		64%
		73%
		82%
		91%

#### Thirteenths

Fraction	Decimal	Percent
		7.69%
		15%
		23%
		31%
		38%
		46%
		54%
		62%
		69%
		77%
		85%
		92%

#### Sevenths

Fraction	Decimal	Percent
1/7	0.14	14.3%
2/7	0.29	29%
3/7	0.43	43%
4/7	0.57	57%
5/7	0.71	71%
6/7	0.86	86%

#### Elevenths

Fraction	Decimal	Percent
1/11	0.09	9.09%
2/11	0.18	18%
3/11	0.27	27%
4/11	0.36	36%
5/11	0.45	45%
6/11	0.55	55%
7/11	0.64	64%
8/11	0.73	73%
9/11	0.82	82%
10/11	0.91	91%

#### Thirteenths

Fraction	Decimal	Percent
1/13	0.08	7.69%
2/13	0.15	15%
3/13	0.23	23%
4/13	0.31	31%
5/13	0.38	38%
6/13	0.46	46%
7/13	0.54	54%
8/13	0.62	62%
9/13	0.69	69%
10/13	0.77	77%
11/13	0.85	85%
12/13	0.92	92%

## Common FDPs #4

### Fifteenths

Fraction	Decimal	Percent
1/15		
2/15		
4/15		
7/15		
8/15		
11/15		
13/15		
14/15		

### Twentyths

Fraction	Decimal	Percent
1/20		
3/20		
7/20		
9/20		
11/20		
13/20		
17/20		
19/20		

### Twenty Fifths

Fraction	Decimal	Percent
1/25		
2/25		
3/25		

### Fiftyths & Hundreths

Fraction	Decimal	Percent
1/50		
1/100		

### Fifteenths

Fraction	Decimal	Percent
1/15	0.07	6.7%
2/15	0.13	13.3%
4/15	0.27	26.7%
7/15	0.47	46.7%
8/15	0.53	53.3%
11/15	0.73	73.3%
13/15	0.87	86.7%
14/15	0.93	93.3%

### Twentyths

Fraction	Decimal	Percent
1/20	0.05	5%
3/20	0.15	15%
7/20	0.35	35%
9/20	0.45	45%
11/20	0.55	55%
13/20	0.65	65%
17/20	0.85	85%
19/20	0.95	95%

### Twenty Fifths

Fraction	Decimal	Percent
1/25	0.04	4%
2/25	0.08	8%
3/25	0.12	12%

### Fiftyths & Hundreths

Fraction	Decimal	Percent
1/50	0.02	2%
1/100	0.01	1%

## Common FDPs #4

### Fifteenths

Fraction	Decimal	Percent
	0.07	
	0.13	
	0.27	
	0.47	
	0.53	
	0.73	
	0.87	
	0.93	

### Twentyths

Fraction	Decimal	Percent
	0.05	
	0.15	
	0.35	
	0.45	
	0.55	
	0.65	
	0.85	
	0.95	

### Twenty Fifths

Fraction	Decimal	Percent
	0.04	
	0.08	
	0.12	

### Fiftyths & Hundreths

Fraction	Decimal	Percent
	0.02	
	0.01	

### Fifteenths

Fraction	Decimal	Percent
1/15	0.07	6.7%
2/15	0.13	13.3%
4/15	0.27	26.7%
7/15	0.47	46.7%
8/15	0.53	53.3%
11/15	0.73	73.3%
13/15	0.87	86.7%
14/15	0.93	93.3%

### Twentyths

Fraction	Decimal	Percent
1/20	0.05	5%
3/20	0.15	15%
7/20	0.35	35%
9/20	0.45	45%
11/20	0.55	55%
13/20	0.65	65%
17/20	0.85	85%
19/20	0.95	95%

### Twenty Fifths

Fraction	Decimal	Percent
1/25	0.04	4%
2/25	0.08	8%
3/25	0.12	12%

### Fiftyths & Hundreths

Fraction	Decimal	Percent
1/50	0.02	2%
1/100	0.01	1%

## Common FDPs #4

### Fifteenths

Fraction	Decimal	Percent
		6.7%
		13.3%
		26.7%
		46.7%
		53.3%
		73.3%
		86.7%
		93.3%

### Twentyths

Fraction	Decimal	Percent
		5%
		15%
		35%
		45%
		55%
		65%
		85%
		95%

### Twenty Fifths

Fraction	Decimal	Percent
		4%
		8%
		12%

### Fiftyths & Hundreths

Fraction	Decimal	Percent
		2%
		1%

### Fifteenths

Fraction	Decimal	Percent
1/15	0.07	6.7%
2/15	0.13	13.3%
4/15	0.27	26.7%
7/15	0.47	46.7%
8/15	0.53	53.3%
11/15	0.73	73.3%
13/15	0.87	86.7%
14/15	0.93	93.3%

### Twentyths

Fraction	Decimal	Percent
1/20	0.05	5%
3/20	0.15	15%
7/20	0.35	35%
9/20	0.45	45%
11/20	0.55	55%
13/20	0.65	65%
17/20	0.85	85%
19/20	0.95	95%

### Twenty Fifths

Fraction	Decimal	Percent
1/25	0.04	4%
2/25	0.08	8%
3/25	0.12	12%

### Fiftyths & Hundreths

Fraction	Decimal	Percent
1/50	0.02	2%
1/100	0.01	1%

## Squares

### Squares of Integers

Square	Equals
1 <sup>2</sup>	
2 <sup>2</sup>	
3 <sup>2</sup>	
4 <sup>2</sup>	
5 <sup>2</sup>	
6 <sup>2</sup>	
7 <sup>2</sup>	
8 <sup>2</sup>	
9 <sup>2</sup>	
10 <sup>2</sup>	
11 <sup>2</sup>	
12 <sup>2</sup>	
13 <sup>2</sup>	
14 <sup>2</sup>	
15 <sup>2</sup>	

Square	Equals
16 <sup>2</sup>	
17 <sup>2</sup>	
18 <sup>2</sup>	
19 <sup>2</sup>	
20 <sup>2</sup>	
25 <sup>2</sup>	
30 <sup>2</sup>	
40 <sup>2</sup>	
50 <sup>2</sup>	
60 <sup>2</sup>	
70 <sup>2</sup>	
80 <sup>2</sup>	
90 <sup>2</sup>	
100 <sup>2</sup>	
150 <sup>2</sup>	
200 <sup>2</sup>	
500 <sup>2</sup>	
1000 <sup>2</sup>	

### Squares of Non-Integers

Square	Equals
1.4 <sup>2</sup>	
1.7 <sup>2</sup>	
2.25 <sup>2</sup>	
2.45 <sup>2</sup>	
2.65 <sup>2</sup>	
2.83 <sup>2</sup>	
3.16 <sup>2</sup>	
3.32 <sup>2</sup>	
3.46 <sup>2</sup>	
3.61 <sup>2</sup>	
3.74 <sup>2</sup>	
3.87 <sup>2</sup>	
4.47 <sup>2</sup>	
5.84 <sup>2</sup>	
6.32 <sup>2</sup>	
7.07 <sup>2</sup>	

### Squares of Integers

Square	Equals
1 <sup>2</sup>	1
2 <sup>2</sup>	4
3 <sup>2</sup>	9
4 <sup>2</sup>	16
5 <sup>2</sup>	25
6 <sup>2</sup>	36
7 <sup>2</sup>	49
8 <sup>2</sup>	64
9 <sup>2</sup>	81
10 <sup>2</sup>	100
11 <sup>2</sup>	121
12 <sup>2</sup>	144
13 <sup>2</sup>	169
14 <sup>2</sup>	196
15 <sup>2</sup>	225

Square	Equals
16 <sup>2</sup>	256
17 <sup>2</sup>	289
18 <sup>2</sup>	324
19 <sup>2</sup>	361
20 <sup>2</sup>	400
25 <sup>2</sup>	625
30 <sup>2</sup>	900
40 <sup>2</sup>	1,600
50 <sup>2</sup>	2,500
60 <sup>2</sup>	3,600
70 <sup>2</sup>	4,900
80 <sup>2</sup>	6,400
90 <sup>2</sup>	8,100
100 <sup>2</sup>	10,000
150 <sup>2</sup>	22,500
200 <sup>2</sup>	40,000
500 <sup>2</sup>	250,000
1000 <sup>2</sup>	1,000,000

### Squares of Non-Integers

Square	Equals
1.4 <sup>2</sup>	2
1.7 <sup>2</sup>	3
2.25 <sup>2</sup>	5
2.45 <sup>2</sup>	6
2.65 <sup>2</sup>	7
2.83 <sup>2</sup>	8
3.16 <sup>2</sup>	10
3.32 <sup>2</sup>	11
3.46 <sup>2</sup>	12
3.61 <sup>2</sup>	13
3.74 <sup>2</sup>	14
3.87 <sup>2</sup>	15
4.47 <sup>2</sup>	20
5.84 <sup>2</sup>	30
6.32 <sup>2</sup>	40
7.07 <sup>2</sup>	50

## Square Roots

### Square Roots of Integers

Square Root	Equals
√1	
√2	
√9	
√16	
√25	
√36	
√49	
√64	
√81	
√100	
√121	
√144	
√169	
√196	
√225	

Square Root	Equals
√256	
√289	
√324	
√361	
√400	
√625	
√900	
√1600	
√2500	
√3600	
√4900	
√6400	
√8100	
√10000	
√22500	
√40000	
√250000	
√1000000	

### Square Roots of Non-Integers

Square Root	Equals
√2	
√3	
√5	
√6	
√7	
√8	
√10	
√11	
√12	
√13	
√14	
√15	
√20	
√30	
√40	
√50	

### Square Roots of Integers

Square Root	Equals
√1	1
√2	2
√9	3
√16	4
√25	5
√36	6
√49	7
√64	8
√81	9
√100	10
√121	11
√144	12
√169	13
√196	14
√225	15

Square Root	Equals
√256	16
√289	17
√324	18
√361	19
√400	20
√625	25
√900	30
√1600	40
√2500	50
√3600	60
√4900	70
√6400	80
√8100	90
√10000	100
√22500	150
√40000	200
√250000	500
√1000000	1000

### Square Roots of Non-Integers

Square Root	Equals
√2	1.41
√3	1.73
√5	2.24
√6	2.45
√7	2.65
√8	2.83
√10	3.16
√11	3.32
√12	3.46
√13	3.61
√14	3.74
√15	3.87
√20	4.47
√30	5.48
√40	6.32
√50	7.07

## Cubes & Cube Roots

### Cubes

Cube	Equals
1 <sup>3</sup>	
2 <sup>3</sup>	
3 <sup>3</sup>	
4 <sup>3</sup>	
5 <sup>3</sup>	
6 <sup>3</sup>	
7 <sup>3</sup>	
8 <sup>3</sup>	
9 <sup>3</sup>	
10 <sup>3</sup>	

### Cube Roots

Cube Root	Equals
<sup>3</sup> √1	
<sup>3</sup> √8	
<sup>3</sup> √27	
<sup>3</sup> √64	
<sup>3</sup> √125	
<sup>3</sup> √216	
<sup>3</sup> √343	
<sup>3</sup> √512	
<sup>3</sup> √729	
<sup>3</sup> √1000	

### Cubes

Cube	Equals
1 <sup>3</sup>	1
2 <sup>3</sup>	8
3 <sup>3</sup>	27
4 <sup>3</sup>	64
5 <sup>3</sup>	125
6 <sup>3</sup>	216
7 <sup>3</sup>	343
8 <sup>3</sup>	512
9 <sup>3</sup>	729
10 <sup>3</sup>	1000

### Cube Roots

Cube Root	Equals
<sup>3</sup> √1	1
<sup>3</sup> √8	2
<sup>3</sup> √27	3
<sup>3</sup> √64	4
<sup>3</sup> √125	5
<sup>3</sup> √216	6
<sup>3</sup> √343	7
<sup>3</sup> √512	8
<sup>3</sup> √729	9
<sup>3</sup> √1000	10

## Powers of 2, 3, 4, and 5

### Powers of 2

2 <sup>x</sup> ?	Equals
2 <sup>1</sup>	
2 <sup>2</sup>	
2 <sup>3</sup>	
2 <sup>4</sup>	
2 <sup>5</sup>	
2 <sup>6</sup>	
2 <sup>7</sup>	
2 <sup>8</sup>	
2 <sup>9</sup>	
2 <sup>10</sup>	

### Powers of 3

3 <sup>x</sup> ?	Equals
3 <sup>1</sup>	
3 <sup>2</sup>	
3 <sup>3</sup>	
3 <sup>4</sup>	
3 <sup>5</sup>	
3 <sup>6</sup>	
3 <sup>7</sup>	
3 <sup>8</sup>	
3 <sup>9</sup>	
3 <sup>10</sup>	

### Powers of 4

4 <sup>x</sup> ?	Equals
4 <sup>1</sup>	
4 <sup>2</sup>	
4 <sup>3</sup>	
4 <sup>4</sup>	
4 <sup>5</sup>	
4 <sup>6</sup>	
4 <sup>7</sup>	
4 <sup>8</sup>	
4 <sup>9</sup>	
4 <sup>10</sup>	

### Powers of 5

5 <sup>x</sup> ?	Equals
5 <sup>1</sup>	
5 <sup>2</sup>	
5 <sup>3</sup>	
5 <sup>4</sup>	
5 <sup>5</sup>	
5 <sup>6</sup>	
5 <sup>7</sup>	
5 <sup>8</sup>	
5 <sup>9</sup>	
5 <sup>10</sup>	

### Powers of 2

2 <sup>x</sup> ?	Equals
2 <sup>1</sup>	2
2 <sup>2</sup>	4
2 <sup>3</sup>	8
2 <sup>4</sup>	16
2 <sup>5</sup>	32
2 <sup>6</sup>	64
2 <sup>7</sup>	128
2 <sup>8</sup>	256
2 <sup>9</sup>	512
2 <sup>10</sup>	1,024

### Powers of 3

3 <sup>x</sup> ?	Equals
3 <sup>1</sup>	3
3 <sup>2</sup>	9
3 <sup>3</sup>	27
3 <sup>4</sup>	81
3 <sup>5</sup>	243
3 <sup>6</sup>	729
3 <sup>7</sup>	2,187
3 <sup>8</sup>	6,561
3 <sup>9</sup>	19,683
3 <sup>10</sup>	59,049

### Powers of 4

4 <sup>x</sup> ?	Equals
4 <sup>1</sup>	4
4 <sup>2</sup>	16
4 <sup>3</sup>	64
4 <sup>4</sup>	256
4 <sup>5</sup>	1,024
4 <sup>6</sup>	4,096
4 <sup>7</sup>	16,384
4 <sup>8</sup>	65,536
4 <sup>9</sup>	262,144
4 <sup>10</sup>	1,048,576

### Powers of 5

5 <sup>x</sup> ?	Equals
5 <sup>1</sup>	5
5 <sup>2</sup>	25
5 <sup>3</sup>	125
5 <sup>4</sup>	625
5 <sup>5</sup>	3,125
5 <sup>6</sup>	15,625
5 <sup>7</sup>	78,125
5 <sup>8</sup>	390,625
5 <sup>9</sup>	1,953,125
5 <sup>10</sup>	9,765,625

## Powers of 2, 3, 4, and 5

### Powers of 2

#	Equals
2	2 <sup>x</sup> ?
4	2 <sup>x</sup> ?
8	2 <sup>x</sup> ?
16	2 <sup>x</sup> ?
32	2 <sup>x</sup> ?
64	2 <sup>x</sup> ?
128	2 <sup>x</sup> ?
256	2 <sup>x</sup> ?
512	2 <sup>x</sup> ?
1024	2 <sup>x</sup> ?

### Powers of 3

#	Equals
3	3 <sup>x</sup> ?
9	3 <sup>x</sup> ?
27	3 <sup>x</sup> ?
81	3 <sup>x</sup> ?
243	3 <sup>x</sup> ?
729	3 <sup>x</sup> ?
2,187	3 <sup>x</sup> ?
6,561	3 <sup>x</sup> ?
19,683	3 <sup>x</sup> ?
59,049	3 <sup>x</sup> ?

### Powers of 4

#	Equals
4	4 <sup>x</sup> ?
16	4 <sup>x</sup> ?
64	4 <sup>x</sup> ?
256	4 <sup>x</sup> ?
1,024	4 <sup>x</sup> ?
4,096	4 <sup>x</sup> ?
16,384	4 <sup>x</sup> ?
65,536	4 <sup>x</sup> ?
262,144	4 <sup>x</sup> ?
1,048,576	4 <sup>x</sup> ?

### Powers of 5

#	Equals
5	5 <sup>x</sup> ?
25	5 <sup>x</sup> ?
125	5 <sup>x</sup> ?
625	5 <sup>x</sup> ?
3,125	5 <sup>x</sup> ?
15,625	5 <sup>x</sup> ?
78,125	5 <sup>x</sup> ?
390,625	5 <sup>x</sup> ?
1,953,125	5 <sup>x</sup> ?
9,765,625	5 <sup>x</sup> ?

### Powers of 2

#	Equals
2	2 <sup>1</sup>
4	2 <sup>2</sup>
8	2 <sup>3</sup>
16	2 <sup>4</sup>
32	2 <sup>5</sup>
64	2 <sup>6</sup>
128	2 <sup>7</sup>
256	2 <sup>8</sup>
512	2 <sup>9</sup>
1024	2 <sup>10</sup>

### Powers of 3

#	Equals
3	3 <sup>1</sup>
9	3 <sup>2</sup>
27	3 <sup>3</sup>
81	3 <sup>4</sup>
243	3 <sup>5</sup>
729	3 <sup>6</sup>
2,187	3 <sup>7</sup>
6,561	3 <sup>8</sup>
19,683	3 <sup>9</sup>
59,049	3 <sup>10</sup>

### Powers of 4

#	Equals
4	4 <sup>1</sup>
16	4 <sup>2</sup>
64	4 <sup>3</sup>
256	4 <sup>4</sup>
1,024	4 <sup>5</sup>
4,096	4 <sup>6</sup>
16,384	4 <sup>7</sup>
65,536	4 <sup>8</sup>
262,144	4 <sup>9</sup>
1,048,576	4 <sup>10</sup>

### Powers of 5

#	Equals
5	5 <sup>1</sup>
25	5 <sup>2</sup>
125	5 <sup>3</sup>
625	5 <sup>4</sup>
3,125	5 <sup>5</sup>
15,625	5 <sup>6</sup>
78,125	5 <sup>7</sup>
390,625	5 <sup>8</sup>
1,953,125	5 <sup>9</sup>
9,765,625	5 <sup>10</sup>

## Multiplication Table (25x25)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
2	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
3	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75
4	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100
5	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125
6	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126	132	138	144	150
7	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147	154	161	168	175
8	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192	200
9	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	162	171	180	189	198	207	216	225
10	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
11	11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176	187	198	209	220	231	242	253	264	275
12	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240	252	264	276	288	300
13	13	26	39	52	65	78	91	104	117	130	143	156	169	182	195	208	221	234	247	260	273	286	299	312	325
14	14	28	42	56	70	84	98	112	126	140	154	168	182	196	210	224	238	252	266	280	294	308	322	336	350
15	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360	375
16	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	256	272	288	304	320	336	352	368	384	400
17	17 <td>34</td> <td>51</td> <td>68</td> <td>85</td> <td>102</td> <td>119</td> <td>136</td> <td>153</td> <td>170</td> <td>187</td> <td>204</td> <td>221</td> <td>238</td> <td>255</td> <td>272</td> <td>289</td> <td>306</td> <td>323</td> <td>340</td> <td>357</td> <td>374</td> <td>391</td> <td>408</td> <td>425</td>	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340	357	374	391	408	425
18	18 <td>36<td>54<td>72<td>90<td>108<td>126<td>144<td>162<td>180<td>198<td>216<td>234<td>252<td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	36 <td>54<td>72<td>90<td>108<td>126<td>144<td>162<td>180<td>198<td>216<td>234<td>252<td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	54 <td>72<td>90<td>108<td>126<td>144<td>162<td>180<td>198<td>216<td>234<td>252<td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	72 <td>90<td>108<td>126<td>144<td>162<td>180<td>198<td>216<td>234<td>252<td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	90 <td>108<td>126<td>144<td>162<td>180<td>198<td>216<td>234<td>252<td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	108 <td>126<td>144<td>162<td>180<td>198<td>216<td>234<td>252<td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	126 <td>144<td>162<td>180<td>198<td>216<td>234<td>252<td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	144 <td>162<td>180<td>198<td>216<td>234<td>252<td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	162 <td>180<td>198<td>216<td>234<td>252<td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	180 <td>198<td>216<td>234<td>252<td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	198 <td>216<td>234<td>252<td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td></td></td></td>	216 <td>234<td>252<td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td></td></td>	234 <td>252<td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td></td>	252 <td>270<td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td></td>	270 <td>288<td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td></td>	288 <td>306<td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td></td>	306 <td>324<td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td></td>	324 <td>342<td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td></td>	342 <td>360<td>378<td>396<td>414<td>432<td>450</td></td></td></td></td></td>	360 <td>378<td>396<td>414<td>432<td>450</td></td></td></td></td>	378 <td>396<td>414<td>432<td>450</td></td></td></td>	396 <td>414<td>432<td>450</td></td></td>	414 <td>432<td>450</td></td>	432 <td>450</td>	450
19	19 <td>38<td>57<td>76<td>95<td>114<td>133<td>152<td>171<td>190<td>209<td>228<td>247<td>266<td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	38 <td>57<td>76<td>95<td>114<td>133<td>152<td>171<td>190<td>209<td>228<td>247<td>266<td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	57 <td>76<td>95<td>114<td>133<td>152<td>171<td>190<td>209<td>228<td>247<td>266<td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	76 <td>95<td>114<td>133<td>152<td>171<td>190<td>209<td>228<td>247<td>266<td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	95 <td>114<td>133<td>152<td>171<td>190<td>209<td>228<td>247<td>266<td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	114 <td>133<td>152<td>171<td>190<td>209<td>228<td>247<td>266<td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	133 <td>152<td>171<td>190<td>209<td>228<td>247<td>266<td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	152 <td>171<td>190<td>209<td>228<td>247<td>266<td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	171 <td>190<td>209<td>228<td>247<td>266<td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	190 <td>209<td>228<td>247<td>266<td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	209 <td>228<td>247<td>266<td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td></td></td></td>	228 <td>247<td>266<td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td></td></td>	247 <td>266<td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td></td>	266 <td>285<td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td></td>	285 <td>304<td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td></td>	304 <td>323<td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td></td>	323 <td>342<td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td></td>	342 <td>361<td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td></td>	361 <td>380<td>399<td>418<td>437<td>456<td>475</td></td></td></td></td></td>	380 <td>399<td>418<td>437<td>456<td>475</td></td></td></td></td>	399 <td>418<td>437<td>456<td>475</td></td></td></td>	418 <td>437<td>456<td>475</td></td></td>	437 <td>456<td>475</td></td>	456 <td>475</td>	475
20	20 <td>40<td>60<td>80<td>100<td>120<td>140<td>160<td>180<td>200<td>220<td>240<td>260<td>280<td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	40 <td>60<td>80<td>100<td>120<td>140<td>160<td>180<td>200<td>220<td>240<td>260<td>280<td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	60 <td>80<td>100<td>120<td>140<td>160<td>180<td>200<td>220<td>240<td>260<td>280<td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	80 <td>100<td>120<td>140<td>160<td>180<td>200<td>220<td>240<td>260<td>280<td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	100 <td>120<td>140<td>160<td>180<td>200<td>220<td>240<td>260<td>280<td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	120 <td>140<td>160<td>180<td>200<td>220<td>240<td>260<td>280<td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	140 <td>160<td>180<td>200<td>220<td>240<td>260<td>280<td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	160 <td>180<td>200<td>220<td>240<td>260<td>280<td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	180 <td>200<td>220<td>240<td>260<td>280<td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	200 <td>220<td>240<td>260<td>280<td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	220 <td>240<td>260<td>280<td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td></td></td></td>	240 <td>260<td>280<td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td></td></td>	260 <td>280<td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td></td>	280 <td>300<td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td></td>	300 <td>320<td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td></td>	320 <td>340<td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td></td>	340 <td>360<td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td></td>	360 <td>380<td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td></td>	380 <td>400<td>420<td>440<td>460<td>480<td>500</td></td></td></td></td></td>	400 <td>420<td>440<td>460<td>480<td>500</td></td></td></td></td>	420 <td>440<td>460<td>480<td>500</td></td></td></td>	440 <td>460<td>480<td>500</td></td></td>	460 <td>480<td>500</td></td>	480 <td>500</td>	500
21	21 <td>42<td>63<td>84<td>105<td>126<td>147<td>168<td>189<td>210<td>231<td>252<td>273<td>294<td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	42 <td>63<td>84<td>105<td>126<td>147<td>168<td>189<td>210<td>231<td>252<td>273<td>294<td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	63 <td>84<td>105<td>126<td>147<td>168<td>189<td>210<td>231<td>252<td>273<td>294<td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	84 <td>105<td>126<td>147<td>168<td>189<td>210<td>231<td>252<td>273<td>294<td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	105 <td>126<td>147<td>168<td>189<td>210<td>231<td>252<td>273<td>294<td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	126 <td>147<td>168<td>189<td>210<td>231<td>252<td>273<td>294<td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	147 <td>168<td>189<td>210<td>231<td>252<td>273<td>294<td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	168 <td>189<td>210<td>231<td>252<td>273<td>294<td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	189 <td>210<td>231<td>252<td>273<td>294<td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	210 <td>231<td>252<td>273<td>294<td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	231 <td>252<td>273<td>294<td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td></td></td></td>	252 <td>273<td>294<td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td></td></td>	273 <td>294<td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td></td>	294 <td>315<td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td></td>	315 <td>336<td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td></td>	336 <td>357<td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td></td>	357 <td>378<td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td></td>	378 <td>399<td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td></td>	399 <td>420<td>441<td>462<td>483<td>504<td>525</td></td></td></td></td></td>	420 <td>441<td>462<td>483<td>504<td>525</td></td></td></td></td>	441 <td>462<td>483<td>504<td>525</td></td></td></td>	462 <td>483<td>504<td>525</td></td></td>	483 <td>504<td>525</td></td>	504 <td>525</td>	525
22	22 <td>44<td>66<td>88<td>110<td>132<td>154<td>176<td>198<td>220<td>242<td>264<td>286<td>308<td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	44 <td>66<td>88<td>110<td>132<td>154<td>176<td>198<td>220<td>242<td>264<td>286<td>308<td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	66 <td>88<td>110<td>132<td>154<td>176<td>198<td>220<td>242<td>264<td>286<td>308<td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	88 <td>110<td>132<td>154<td>176<td>198<td>220<td>242<td>264<td>286<td>308<td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	110 <td>132<td>154<td>176<td>198<td>220<td>242<td>264<td>286<td>308<td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	132 <td>154<td>176<td>198<td>220<td>242<td>264<td>286<td>308<td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	154 <td>176<td>198<td>220<td>242<td>264<td>286<td>308<td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	176 <td>198<td>220<td>242<td>264<td>286<td>308<td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	198 <td>220<td>242<td>264<td>286<td>308<td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	220 <td>242<td>264<td>286<td>308<td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	242 <td>264<td>286<td>308<td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td></td></td></td>	264 <td>286<td>308<td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td></td></td>	286 <td>308<td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td></td>	308 <td>330<td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td></td>	330 <td>352<td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td></td>	352 <td>374<td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td></td>	374 <td>396<td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td></td>	396 <td>418<td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td></td>	418 <td>440<td>462<td>484<td>506<td>528<td>550</td></td></td></td></td></td>	440 <td>462<td>484<td>506<td>528<td>550</td></td></td></td></td>	462 <td>484<td>506<td>528<td>550</td></td></td></td>	484 <td>506<td>528<td>550</td></td></td>	506 <td>528<td>550</td></td>	528 <td>550</td>	550
23	23 <td>46<td>69<td>92<td>115<td>138<td>161<td>184<td>207<td>230<td>253<td>276<td>299<td>322<td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	46 <td>69<td>92<td>115<td>138<td>161<td>184<td>207<td>230<td>253<td>276<td>299<td>322<td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	69 <td>92<td>115<td>138<td>161<td>184<td>207<td>230<td>253<td>276<td>299<td>322<td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	92 <td>115<td>138<td>161<td>184<td>207<td>230<td>253<td>276<td>299<td>322<td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	115 <td>138<td>161<td>184<td>207<td>230<td>253<td>276<td>299<td>322<td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	138 <td>161<td>184<td>207<td>230<td>253<td>276<td>299<td>322<td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	161 <td>184<td>207<td>230<td>253<td>276<td>299<td>322<td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	184 <td>207<td>230<td>253<td>276<td>299<td>322<td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	207 <td>230<td>253<td>276<td>299<td>322<td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	230 <td>253<td>276<td>299<td>322<td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	253 <td>276<td>299<td>322<td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td></td></td></td>	276 <td>299<td>322<td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td></td></td>	299 <td>322<td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td></td>	322 <td>345<td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td></td>	345 <td>368<td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td></td>	368 <td>391<td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td></td>	391 <td>414<td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td></td>	414 <td>437<td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td></td>	437 <td>460<td>483<td>506<td>529<td>552<td>575</td></td></td></td></td></td>	460 <td>483<td>506<td>529<td>552<td>575</td></td></td></td></td>	483 <td>506<td>529<td>552<td>575</td></td></td></td>	506 <td>529<td>552<td>575</td></td></td>	529 <td>552<td>575</td></td>	552 <td>575</td>	575
24	24 <td>48<td>72<td>96<td>120<td>144<td>168<td>192<td>216<td>240<td>264<td>288<td>312<td>336<td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	48 <td>72<td>96<td>120<td>144<td>168<td>192<td>216<td>240<td>264<td>288<td>312<td>336<td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	72 <td>96<td>120<td>144<td>168<td>192<td>216<td>240<td>264<td>288<td>312<td>336<td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	96 <td>120<td>144<td>168<td>192<td>216<td>240<td>264<td>288<td>312<td>336<td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	120 <td>144<td>168<td>192<td>216<td>240<td>264<td>288<td>312<td>336<td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	144 <td>168<td>192<td>216<td>240<td>264<td>288<td>312<td>336<td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	168 <td>192<td>216<td>240<td>264<td>288<td>312<td>336<td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	192 <td>216<td>240<td>264<td>288<td>312<td>336<td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	216 <td>240<td>264<td>288<td>312<td>336<td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	240 <td>264<td>288<td>312<td>336<td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	264 <td>288<td>312<td>336<td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td></td></td></td>	288 <td>312<td>336<td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td></td></td>	312 <td>336<td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td></td>	336 <td>360<td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td></td>	360 <td>384<td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td></td>	384 <td>408<td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td></td>	408 <td>432<td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td></td>	432 <td>456<td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td></td>	456 <td>480<td>504<td>528<td>552<td>576<td>600</td></td></td></td></td></td>	480 <td>504<td>528<td>552<td>576<td>600</td></td></td></td></td>	504 <td>528<td>552<td>576<td>600</td></td></td></td>	528 <td>552<td>576<td>600</td></td></td>	552 <td>576<td>600</td></td>	576 <td>600</td>	600
25	25 <td>50<td>75<td>100<td>125<td>150<td>175<td>200<td>225<td>250<td>275<td>300<td>325<td>350<td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	50 <td>75<td>100<td>125<td>150<td>175<td>200<td>225<td>250<td>275<td>300<td>325<td>350<td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	75 <td>100<td>125<td>150<td>175<td>200<td>225<td>250<td>275<td>300<td>325<td>350<td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	100 <td>125<td>150<td>175<td>200<td>225<td>250<td>275<td>300<td>325<td>350<td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	125 <td>150<td>175<td>200<td>225<td>250<td>275<td>300<td>325<td>350<td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	150 <td>175<td>200<td>225<td>250<td>275<td>300<td>325<td>350<td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	175 <td>200<td>225<td>250<td>275<td>300<td>325<td>350<td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	200 <td>225<td>250<td>275<td>300<td>325<td>350<td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	225 <td>250<td>275<td>300<td>325<td>350<td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td></td></td></td></td></td>	250 <td>275<td>300<td>325<td>350<td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td></td></td></td></td>	275 <td>300<td>325<td>350<td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td></td></td></td>	300 <td>325<td>350<td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td></td></td>	325 <td>350<td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td></td>	350 <td>375<td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td></td>	375 <td>400<td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td></td>	400 <td>425<td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td></td>	425 <td>450<td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td></td>	450 <td>475<td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td></td>	475 <td>500<td>525<td>550<td>575<td>600</td><td>625</td></td></td></td></td>	500 <td>525<td>550<td>575<td>600</td><td>625</td></td></td></td>	525 <td>550<td>575<td>600</td><td>625</td></td></td>	550 <td>575<td>600</td><td>625</td></td>	575 <td>600</td> <td>625</td>	600	625

### Common Right Triangles (Pythagorean Triplets)

Common Combinations	Key Multiples
<b>a-b-c</b> $a^2 + b^2 = c^2$ $(a + b = c)$	a-b-c a-b-c a-b-c
<b>a-b-c</b> $a^2 + b^2 = c^2$ $(a + b = c)$	a-b-c
<b>a-b-c</b> $a^2 + b^2 = c^2$ $(a + b = c)$	n/a

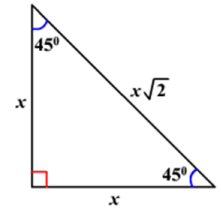
Common Combinations	Key Multiples
<b>3-4-5</b> $3^2 + 4^2 = 5^2$ $(9 + 16 = 25)$	6-8-10 9-12-15 12-16-20
<b>5-12-13</b> $5^2 + 12^2 = 13^2$ $(25 + 144 = 169)$	10-24-26
<b>8-15-17</b> $8^2 + 15^2 = 17^2$ $(64 + 225 = 289)$	n/a

### Isosceles Right Triangle

- Angle of legs and hypotenuse
- Ratio of length of sides
- Area
- Hypotenuse = ?

#### 45-45-90 Triangle Legs

	Leg	Leg	Hypotenuse
Angle:	45°	45°	90°
Ratio:	x	x	x√2
	1	1	√2



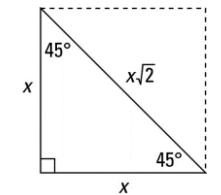
#### Pythagorean Theorem

$$x^2 + x^2 = c^2 \quad 2x^2 = c^2 \quad x\sqrt{2} = c$$

----> hypotenuse = leg\*√2

Area =  $x^2 / 2$

Hypotenuse = diagonal of a square



### 30-60-90 Right Triangle

- Angle of legs and hypotenuse
- Ratio of length of sides
- Area
- Hypotenuse = ?

#### 30-60-90 Triangle Legs

	Short Leg	Long Leg	Hypotenuse
Angle:	30°	60°	90°
Ratio:	x	x√3	2x
	1	√3	2

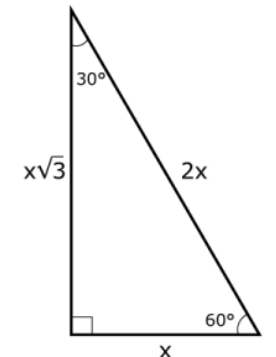
#### Pythagorean Theorem

$$x^2 + 3x^2 = c^2 \quad 4x^2 = c^2 \quad 2x = c$$

----> hypotenuse = short leg\*2  
 ----> long leg = short leg\*√3

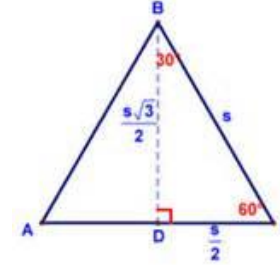
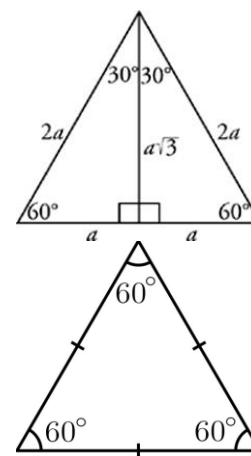
Area =  $x^2\sqrt{3} / 2$

Hypotenuse = side of equilateral triangle



## Equilateral Triangle

- Angles and sides
- Side, base, and height from 30-60-90 triangle
- Area
- Radius of circumscribed circle
- Radius of inscribed circle



$$A = \frac{1}{2}bh$$

$$A = \frac{1}{2}(s)\left(\frac{s\sqrt{3}}{2}\right)$$

$$A = \frac{s^2\sqrt{3}}{4}$$

- Radius of circumscribed circle =  $s\sqrt{3} / 3$
- Radius of inscribed circle =  $s\sqrt{3} / 6$

## Triangles Overview

Properties	Type of Triangles			
	Scalene	Isosceles	Equilateral	Right-Angled
Side Property	•None of the sides are equal. • $a \neq b \neq c \neq a$ where a, b and c are three sides of the triangle.	•Two side are equal. • $a = b = c$ , where a, b and c are the three sides of the triangle.	•All the sides are equal. • $a = b = c$ , where a, b and c are the three sides of the triangle.	•Two sides forming the right angle may or may not be equal. •If they are equal the triangle is known as isosceles right-angled triangle.
Angle Property	•All the angles are distinct.	•Angles opposite to equal sides are equal.	•All angles are equal to $60^\circ$ .	•One of the angles is $90^\circ$ .
Area Formula	•Area = $\frac{1}{2}$ x base x height •The above formula is applicable to triangles.	•Area = $\frac{\sqrt{3}}{4} \times a^2$ , where 'a' is the length of a side of the triangle.	•Area = $\frac{\sqrt{3}}{4} \times a^2$ , where 'a' is the length of a side of the triangle.	•Area = $(\frac{1}{2})$ x base x perpendicular
Special Property		•The perpendicular drawn to the unequal side, divides it into two equal parts.	•The perpendicular from any vertex, divides the opposite side into 2 equal halves.	•According to Pythagoras Theorem, $c^2 = a^2 + b^2$ , where c is the largest side/hypotenuse
Diagrammatic Representation	<p>1. <math>a \neq b \neq c \neq a</math></p>	<p>1. <math>a = b = c</math> 2. The perpendicular from any vertex, divides the opposite side into 2 equal halves.</p>	<p>1. <math>a = b = c</math> 2. All angles are equal to <math>60^\circ</math>.</p>	<p>1. <math>c^2 = a^2 + b^2</math>, where c is the largest side/hypotenuse 2. Angle <math>ACB = 90^\circ</math></p>

## Geometry Formulas to Know



### Advanced Factoring & Distributing

#### Distributed Form

$$x^2 + x$$

$$x^5 - x^3$$

$$6^5 - 6^3$$

$$4^8 + 4^9 + 4^{10}$$

$$p^3 - p$$

$$a^b + a^{b+1}$$

$$m^n - m^{n-1}$$

$$5^5 - 5^4$$

$$xw + yw + zx + zy$$

#### Distributed Form

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$$x^5 - x^3$$

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$$5^5 - 5^4$$

$$xw + yw + zx + zy$$

#### Factored Form

$$x(x + 1)$$

$$x^3(x^2 - 1) = x^3(x + 1)(x - 1)$$

$$6^3(6^2 - 1) = 35 \cdot 6^3$$

$$4^8 + (1 + 4 + 4^2) = 21 \cdot 4^8$$

$$p(p^2 - 1) = p(p - 1)(p + 1)$$

$$a^b(1 + a)$$

$$m^n(1 - m^{-1}) = m^{n-1}(m - 1)$$

$$5^5(1 - 1/5) = 5^4(5 - 1)$$

$$(w + z)(x + y) = w(x + y) + z(x + y)$$

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### Exponent Rules

- Product Law
- Quotient Law
- Combining Bases Law I
- Combining Bases Law II
- Power of a Power Law
- $x^{-r}$
- $x^0$
- $x^{r/s}$

$$(x^r)(x^s) = x^{(r+s)}$$

$$(2^2)(2^3) = 2^{(2+3)} = 32$$

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

$$\frac{4^5}{4^2} = 4^{5-2} = 4^3 = 64$$

$$(x^r)(y^r) = (xy)^r$$

$$(3^3)(4^3) = 12^3 = 1,728$$

$$\left(\frac{x}{y}\right)^r = \frac{x^r}{y^r}$$

$$\left(\frac{2}{3}\right)^3 = \frac{2^3}{3^3} = \frac{8}{27}$$

$$(x^r)^s = x^{rs} = (x^s)^r$$

$$(x^3)^4 = x^{12} = (x^4)^3$$

$$x^{-r} = \frac{1}{x^r}$$

$$3^{-2} = \frac{1}{3^2} = \frac{1}{9}$$

$$x^0 = 1$$

$$6^0 = 1$$

$$x^{r/s} = (x^{1/s})^r = (x^r)^{1/s} = \sqrt[s]{x^r}$$

$$8^{2/3} = (8^{1/3})^2 = (8^2)^{1/3} = \sqrt[3]{8^2} = 4$$

### Algebraic Identities; Special Products

$(x+y)^2 =$	$x^3+y^3 =$
$(x-y)^2 =$	$x^3-y^3 =$
$x^2-y^2 =$	$(x+y+z)^2 =$
$(x+y)^2-(x-y)^2 =$	

$(x+y)^2 = x^2+y^2+2xy$	$x^3+y^3 = (x+y)(x^2+y^2-xy)$
$(x-y)^2 = x^2+y^2-2xy$	$x^3-y^3 = (x-y)(x^2+y^2+xy)$
$x^2-y^2 = (x+y)(x-y)$	$(x+y+z)^2 = x^2+y^2+z^2+2(xy+yz+zx)$
$(x+y)^2-(x-y)^2 = 4xy$	

### Algebraic Identities; Special Products

$= x^2+y^2+2xy$	$= (x+y)(x^2+y^2-xy)$
$= x^2+y^2-2xy$	$= (x-y)(x^2+y^2+xy)$
$= (x+y)(x-y)$	$= x^2+y^2+z^2+2(xy+yz+zx)$
$= 4xy$	

$(x+y)^2 = x^2+y^2+2xy$	$x^3+y^3 = (x+y)(x^2+y^2-xy)$
$(x-y)^2 = x^2+y^2-2xy$	$x^3-y^3 = (x-y)(x^2+y^2+xy)$
$x^2-y^2 = (x+y)(x-y)$	$(x+y+z)^2 = x^2+y^2+z^2+2(xy+yz+zx)$
$(x+y)^2-(x-y)^2 = 4xy$	

### Fraction/Ratio/Proportion

If  $a : b :: c : d$  or  $\frac{a}{b} = \frac{c}{d}$ , then

- Alternendo Law
- Invertendo Law
- Componendo Law
- Dividendo Law
- Componendo & Dividendo Law

$$\frac{a}{c} = \frac{b}{d}$$

... Alternendo Law

$$\frac{b}{a} = \frac{d}{c}$$

... Invertendo Law

$$\frac{a+b}{b} = \frac{c+d}{d}$$

... Componendo Law

$$\frac{a-b}{b} = \frac{c-d}{d}$$

... Dividendo Law

$$\frac{a+b}{a-b} = \frac{c+d}{c-d}$$

... Componendo and Dividendo Law

## Prime Numbers (up to 100)

- Set of 15
- Set of 10

## Below 50

2	3	5	7	11
13	17	19	23	29
31	37	41	43	47

## Above 50

53	59	61	67	71
73	79	83	89	97

## Factorials - 1! thru 11!

### Common Factorials

1!	= 1	7!	= 7 * 6 * 5 * 4 * 3 * 2 * 1 = 5,040
2!	= 2 * 1 = 2	8!	= 8 * 7 * 6 * 5 * 4 * 3 * 2 * 1 = 40,320
3!	= 3 * 2 * 1 = 6	9!	= 9 * 8 * 7 * 6 * 5 * 4 * 3 * 2 * 1 = 362,880
4!	= 4 * 3 * 2 * 1 = 24	10!	= 10 * 9 * 8 * 7 * 6 * 5 * 4 * 3 * 2 * 1 = 3,628,800
5!	= 5 * 4 * 3 * 2 * 1 = 120	11!	= 11 * 10 * 9 * 8 * 7 * 6 * 5 * 4 * 3 * 2 * 1 = 39,916,800
6!	= 6 * 5 * 4 * 3 * 2 * 1 = 720		

## Evenly Spaced Sets (incl consecutive integers)

- Nth term of sequence
- Mean = Median
- Sum of elements in set (2)
- Sum of n first positive integers
- Sum of n first positive odd integers
- Sum of n first positive even integers

• If the first term is  $a_1$  and the common difference of successive members is  $d$ , then the  $n$ th term of the sequence is given by:  
 $a_n = a_1 + d(n-1)$

• In any evenly spaced set the arithmetic mean (average) is equal to the median and can be calculated by the formula  $mean = median = \frac{a_1 + a_n}{2}$ , where  $a_1$  is the first term and  $a_n$  is the last term. Given the set  $\{7, 11, 15, 19\}$ ,  $mean = median = \frac{7+19}{2} = 13$ .

• The sum of the elements in any evenly spaced set is given by:  
 $Sum = \frac{a_1 + a_n}{2} * n$ , the mean multiplied by the number of terms. OR,  $Sum = \frac{2a_1 + d(n-1)}{2} * n$

Sum of n first positive integers:  $1+2+\dots+n = \frac{1+n}{2} * n$

Sum of n first positive odd numbers:  $a_1 + a_2 + \dots + a_n = 1+3+\dots+a_n = n^2$ , where  $a_n$  is the last,  $n$ th term and given by:  $a_n = 2n-1$ . Given  $n = 5$  first odd positive integers, then their sum equals to  $1+3+5+7+9 = 5^2 = 25$ .

Sum of n first positive even numbers:  $a_1 + a_2 + \dots + a_n = 2+4+\dots+a_n = n(n+1)$ , where  $a_n$  is the last,  $n$ th term and given by:  $a_n = 2n$ . Given  $n = 4$  first positive even integers, then their sum equals to  $2+4+6+8 = 4(4+1) = 20$ .

• If the evenly spaced set contains odd number of elements, the mean is the middle term, so the sum is middle term multiplied by number of terms. There are five terms in the set  $\{1, 7, 13, 19, 25\}$ , middle term is 13, so the sum is  $13*5 = 65$ .

## Integer Properties

- Finding the Number of Factors of an Integer
- Finding the Sum of Factors of an Integer

First make prime factorization of an integer  $n = a^p * b^q * c^r$ , where  $a$ ,  $b$ , and  $c$  are prime factors of  $n$  and  $p$ ,  $q$ , and  $r$  are their powers.

The number of factors of  $n$  will be expressed by the formula  $(p+1)(q+1)(r+1)$ . NOTE: this will include 1 and  $n$  itself.

First make prime factorization of an integer  $n = a^p * b^q * c^r$ , where  $a$ ,  $b$ , and  $c$  are prime factors of  $n$  and  $p$ ,  $q$ , and  $r$  are their powers.

The sum of factors of  $n$  will be expressed by the formula: 
$$\frac{(a^{p+1}-1)*(b^{q+1}-1)*(c^{r+1}-1)}{(a-1)*(b-1)*(c-1)}$$

## Integer Properties

- Finding the Number of Trailing Zeros in  $n!$

### Trailing zeros:

Trailing zeros are a sequence of 0's in the decimal representation (or more generally, in any positional representation) of a number, after which no other digits follow.

125000 has 3 trailing zeros;

The number of trailing zeros in the decimal representation of  $n!$ , the factorial of a non-negative integer  $n$ , can be determined with this formula:

$$\frac{n}{5} + \frac{n}{5^2} + \frac{n}{5^3} + \dots + \frac{n}{5^k}, \text{ where } k \text{ must be chosen such that } 5^k < n.$$

It's easier if you look at an example:

How many zeros are in the end (after which no other digits follow) of  $32!$ ?

$$\frac{32}{5} + \frac{32}{5^2} = 6 + 1 = 7 \quad (\text{denominator must be less than } 32, 5^2 = 25 \text{ is less})$$

Hence, there are 7 zeros in the end of  $32!$

The formula actually counts the number of factors 5 in  $n!$ , but since there are at least as many factors 2, this is equivalent to the number of factors 10, each of which gives one more trailing zero.

## Integer Properties

- Finding the Powers of a Prime in  $n!$
- Finding the Powers of a non-Prime in  $n!$

Finding the number of powers of a prime number  $p$ , in the  $n!$ .

The formula is:

$$\frac{n}{p} + \frac{n}{p^2} + \frac{n}{p^3} \dots \text{till } p^x < n$$

What is the power of 2 in  $25!$ ?

$$\frac{25}{2} + \frac{25}{4} + \frac{25}{8} + \frac{25}{16} = 12 + 6 + 3 + 1 = 22$$

Finding the power of non-prime in  $n!$ :

How many powers of 900 are in  $50!$

Make the primo factorization of the number:  $900 = 2^2 * 3^2 * 5^2$ , then find the powers of those primo numbers in the  $n!$ .

Find the power of 2:

$$\frac{50}{2} + \frac{50}{4} + \frac{50}{8} + \frac{50}{16} + \frac{50}{32} = 25 + 12 + 6 + 3 + 1 = 47 = 2^{47}$$

Find the power of 3:

$$\frac{50}{3} + \frac{50}{9} + \frac{50}{27} = 16 + 5 + 1 = 22 = 3^{22}$$

Find the power of 5:

$$\frac{50}{5} + \frac{50}{25} = 10 + 2 = 12 = 5^{12}$$

We need all the prime [2,3,5] to be represented twice in 900, 5 can provide us with only 6 pairs, thus there is 900 in the power of 6 in  $50!$ .