Grade 8 Math

Category 1 – Numerical Representations & Relationships

REAL NUMBERS

irrational number: real number that cannot be expressed as a ratio

real numbers → rational numbers ($\frac{a}{b}$, b ≠ 0) → integers {…–3, –2, –1, 0, 1, 2, 3, …} → whole numbers {0, 1, 2, 3, 4, …} → counting numbers {1, 2, 3, …}

irrational numbers (e.g. $\sqrt{5}$, π); +, – fractional values (e.g. $-\frac{4}{3}$, $-\frac{1}{10}$, 0.1, 0.3, $\frac{1}{2}$); negative integers {…, –4, –3, –2, –1}; {0}

Approximate irrational numbers with rational ones (e.g., π ≈ 3.14 or $\frac{22}{7}$). Learn squares (e.g., $11^2 = 121$; $12^2 = 144$; $13^2 = 169$; $14^2 = 196$; $15^2 = 225$).

Examples: Estimate the value of $\sqrt{2}$ to the nearest tenth. → find adjacent integers: $1^2 = 1$; $2^2 = 4$; so $1 < \sqrt{2} < 2$ → guess/check or use calculator: $1.3^2 = 1.69$; $1.4^2 = 1.96$ (close to 2); $1.5^2 = 2.25$; so $\sqrt{2} ≈ 1.4$

Which point represents each? $\sqrt{5}$, π, $\sqrt{15}$, $-\frac{1}{3}\pi$, –1, $\frac{11}{3}$ Classify.

→ $\sqrt{5}$: $2^2 = 4$, and $2.2^2 = 4.84$ and $2.3^2 = 5.29$, so $2.2 < \sqrt{5} < 2.3$

→ π ≈ 3.14 → $\sqrt{15}$: $4^2 = 16$; so a little less than 4, $\sqrt{15} ≈ 3.9$

→ $-\frac{1}{3}\pi$: $\frac{3.14}{3} ≈ \frac{3.15}{3} = 1.05$, so $-\frac{1}{3}\pi ≈ -1.05$ → $\frac{11}{3} = \frac{9}{3} + \frac{2}{3} = 3\frac{2}{3} ≈ 3.6$

Answer: {$\sqrt{5}$, π, $\sqrt{15}$, $-\frac{1}{3}\pi$, –1, $\frac{11}{3}$} *is represented by points* {E, G, I, B, C, H}. $\sqrt{5}$, π, $\sqrt{15}$, $-\frac{1}{3}\pi$ are irrational. –1 is rational and an integer. $\frac{11}{3}$ is rat[illegible]

Approximate and order the two diameters and the square's side length. → $A_Y = 66\pi = \pi r^2$; $r = \sqrt{66}$; $8^2 = 64$, so r is [illegible] $8.1^2 = 65.6$, so r ≈ 8.1; d = 2r, so d_Y = [illegible] → $C_B = 44 = \pi d$; $d = \frac{44}{\pi} ≈ 44 ÷ \frac{22}{7} = 44 \times$ [illegible] → $A_G = 220 = s^2$; $s = \sqrt{220}$; $15^2 = 225$; 14[illegible] $14 < s < 15$ (closer to 15 than 14); s_G ≈ [illegible] Answer: 14 < 15 < 16.2 so $d_B < s_G < d_Y$

A = 66π cm²; C = 44 cm; A = 220 cm²

SCIENTIFIC NOTATION

scientific notation: number is expressed as a [illegible] power of 10; factor must be greater than or equal to 1 and le[illegible] × 10⁴)

From	To	Conversion Method
standard notation 0.000035 1,200.8	scientific notation 3.5 x 10^{-5} 1.2008 x 10^3	1. Move decimal point until the[illegible] zero digit to the [illegible] of the new [illegible] 2. Count the de[illegible] to find [illegible] (# to right [illegible] left = +[illegible])
scientific notation 2.05 x 10^{-4} 1.01 x 10^6	standard notation 0.000205 1,010,000	1. Identify th[illegible] many places [illegible] move to left; if a [illegible] 2. Add zeros as needed [illegible] power of 10.

Category 2 – Computations & Algebra[illegible] Relationships

ONE VARIABLE [illegible] AND INEQUALITIES

Write equations [illegible] real-world situation[illegible]

Verbal [illegible]	[illegible] or Inequality
The perimeter of a [illegible] is thr[illegible] the length, l. The rect[illegible]	2w, and l = 3l, so 3l [illegible] + 2([illegible]
Sue's account balance [illegible] twice the minimum, m. K[illegible] smaller [illegible] is 1.5 times [illegible] minimum, m	Kay < Su[illegible] = 2m – 19, and Ka[illegible] m, so 1.5m [illegible] m – 19

[illegible] world situation co[illegible] equation or inequality represent?

[illegible] ation or In[illegible]	[illegible] listic Verbal Description
[illegible]	Monthly c[illegible] n A is $25/mo plus $0.05/min. [illegible] sage [illegible] no plus $0.[illegible] n. Cell phone [illegible] + 0.03t [illegible] e than pl[illegible] for t minutes of [illegible]
[illegible] 5,230 – 50m [illegible]	[illegible] months o[illegible] has $5,230. He spends $50/m[illegible] g or savin[illegible] earns [illegible] has $550. He saves $[illegible] has at [illegible] as much as Ben in m[illegible]

Recall [illegible] simplif[illegible] expressions; (2) isolatin[illegible]

order of operations: 1. Groupings; 2. Exponents; 3. Multipl[illegible] *to right*; 4. Add/Subtract *left to right*

distributive property: a(b + c) = ab + ac

a + (–a) = 0; a + b – b + a; a + (b + c) = (a + b) + c

Example: 1 – 2(3x – 4[illegible] x + 8 = –6x + 9

do unto one side as you do unto the other: perform the sa[illegible] to each whole expression on the left *and* right of the = or ineq[illegible]

inverse operations strip terms and coefficients away from [illegible]

reverse inequality sign: if dividing or multiplying by a negative value

Example: –6x + 9 – 9 ≥ 19 – 9; –6x ≥ 10; $\frac{-6x}{-6} ≤ \frac{10}{-6}$; $x ≤ -\frac{10}{6} = -1\frac{2}{3}$; x ≤ –1.6

SOLVING ONE VARIABLE EQUATIONS

A solution is any value that makes a[illegible] statement true. For a one variable (no exponents) equation, there can b[illegible] an infinite number of solutions.

Examples: $2c = \frac{1}{2}(c - 8)$ | 15 – 3[illegible] | 0.2k – 1.8 = 2(0.1k – 0.9)

$2c - \frac{1}{2}c = \frac{1}{2}c - 4 - \frac{1}{2}c$ | 15[illegible] – 3x + [illegible] | 0.2k – 1.8 = 0.2k – 1.8

$\frac{3}{2}c - \frac{1}{2}c = -4$; $(\frac{2}{3})\frac{3}{2}c = -4(\frac{2}{3})$ | [illegible] = 24 | –0.2k –0.2k

$c = -\frac{8}{3} = -2\frac{2}{3} ≈ -2.6$ | | –1.8 = –1.8 always true

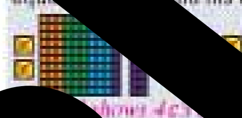
exactly 1 solution for c | | *infinite solutions for k*

Substitute solution(s) into ori[illegible] to che[illegible] or find value

$2(-\frac{8}{3}) = \frac{1}{2}(-\frac{8}{3} - 8)$; $-\frac{16}{3} = -\frac{8}{3} - 4$; $-\frac{16}{3}$ = [illegible]

Models can also be used to solve one [illegible] tions.

Example: Harry sells candles for $6.00 ea[illegible] candle [illegible] costs $2.00. He rent[illegible] tall at the fair for $15.00 per hour [illegible] 8 hours. His costs equa[illegible] find his total sales. [illegible] c = # of c[illegible] sold



→ costs = [illegible] 8 hr) + ($2.00/candle)c → sales = [illegible] candle [illegible] and costs = sales [illegible] = 6c [illegible] 2c = 6c [illegible] del, c = 30, so sales = 6(30) = $180 [illegible] costs [illegible] + 2(30) = 120 + 60 = 180✓

[illegible] shows 4c [illegible] is 30 candle[illegible]

[illegible] variable equa[illegible] by tr[illegible] each [illegible] a simultaneous linear [illegible] tions.

Example: –6x + 9 = 19x → $y_1 = -6x + 9$, $y_2 = 19x$

SO[illegible] SIMULTANEOUS LINEAR EQUATIONS

Id[illegible] ues of x and y that sa[illegible] two simultaneous linear equations [illegible] ing each. The interse[illegible] (s) of the graphs is the solution(s).

[illegible] les:

[illegible] grap[illegible] and y = [illegible] – 1 ordered pairs: {(0, 0); (1, 3)} [illegible] –1); (1, [illegible] intersection [illegible] lution: exactly 1 solution at x = –1 [illegible] that gives same resu[illegible] –3) for both sides of equation, making it true) [illegible] e x in 3x = 2x – 1 to solve. [illegible] 2x = 2x – 1 – 2x → x = –1 [illegible] 3(–1) = –3 or 2(–1) – 1 = –3

[illegible] has $20. He adds $5 each day. Nel has $10. Each day she adds $8 and takes out enough to buy two teas for $1.50 each. When will Nel and Ed have equal amounts?

$M_{Ed} = 20 + 5d$

$M_{Nel} = 10 + 8d - 2(1.5)d = 10 + 8d - 3d = 10 + 5d$

→ Never. Nel has $10 less at all times.

If Nel begins with $20, when would Nel and Ed have equal amounts of money?

→ Always. $M_{Nel} = 20 + 5d$ would graph on top of M_{Ed}, so $M_{Nel} = M_{Ed}$ for all d.

SLOPE OF LINEAR FUNCTIONS

slope, m: for any linear function, the rate at which the y-values change compared to the change in the x-values; **coefficient** of x in y = mx + b

Non-proportions ← Linear Functions → Proportions

y = mx + b, where b ≠ 0 for *any* two (x_1, y_1) and (x_2, y_2): slope, $m = \frac{\text{change in } y}{\text{change in } x} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$

y = mx, y = ax, y = kx, or d = rt; (0, 0) is a point, so for any (x, y): m, a, k, or r = $\frac{\text{change in } y}{\text{change in } x} = \frac{y - 0}{x - 0} = \frac{y}{x}$

Similar right triangles *or* [illegible] show [illegible]

$m = -\frac{1}{2} = -0.5$; $m = \frac{1}{1} = \frac{2}{2} = 1$

[illegible] ate [illegible] and [illegible] *For a* [illegible] w, it is [illegible] uality: [illegible] $\frac{1}{2}$ for [illegible] and [illegible] = $-\frac{1}{2}$

0 mirrors cost $0 [illegible] proportional to number of mirrors), so the slope equals the unit rate

0 3 6 9 12 # of Mirrors

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CR Symbol indicates section aligns to Texas College and Career Readiness Standards.