#59, pg. 160
Difficulty Level: 500-600
Topics: Translations & Manipulations

Solution A – Algebraic Solution

Harry gets paid *x* dollars per hour for the first 30 hours, so after 30 hrs he has earned $30x$. For each extra hour, Harry gets paid $1.5x$. If we call his "extra" hours *h*, Harry receives $(1.5x)(h)$ for his overtime. Therefore the total Harry earns is $30x + (1.5x)(h)$ where *h* is the number of overtime hours.

James gets paid *x* dollars per hour for the first 40 hours, so after 40 hrs he has earned $40x$. For his overtime, James gets paid $2x$ for each hour. Since he only worked 1hr of overtime (his total time is 41hrs), his overtime pay is exactly $2x$. Therefore James' total pay is exactly $40x + 2x = 42x$

Because Harry and James received the same pay, we can set up their pay as equal:

Harry's pay equals James' pay → $30x + (1.5x)(h) = 42x$

To find how long Harry worked, we need to find *h*, his overtime, and add it to the first 30 hrs.

Solve for *h* → $(1.5x)(h) = 42x - 30x$ → $h = \dfrac{12x}{1.5x}$ → $h = \dfrac{12}{1.5}$

Multiply by 2 to get rid of decimals→ $h = \dfrac{12}{1.5}$ → $\dfrac{24}{3}$ →   8hrs

Harry worked 8 overtime hours, so his total number of hours is 30 + 8 = 38hrs

The correct answer is D

Solution B – Reverse Engineering

When a question gives you non-variable answers along with a word problem, you can often use reverse engineering. Reverse Engineering is working from the answer choices, to find which choice can perfectly accommodate all the given data in the question. We already know that James worked 41hrs, and that he was paid *x* for each of the first 40 hrs (a total of 40*x*) and 2*x* for his single overtime hour. Thus we know that Harry was paid 42*x* dollars last week.

Let's reverse engineer the question and figure out which answer choice makes "Harry and James were paid the same amount" true. Start with answer C

Harry's hours	Harry's pay (x for each of 1st 30 hours + 1.5x for each overtime hour)	Is Harry equal to James (42x)?
(A) 35		
(B) 36		
(C) 37	$30x + 7(1.5x) = 40.5x$	Harry's pay is too small. He needs to work more hours. Eliminate A, B & C
(D) 38	$30x + 8(1.5x) = 42x$	**YES**. If Harry works 38hrs, his pay is equal to Jame's
(E) 39		

The correct answer is D

Take-Aways

- When a question gives you non-variable answer choices along with a word problem, you can often use reverse engineering. Start with answer C, especially if it will take more than a few seconds to check each answer.