(1) B
(2) C
(3) D
(4) C
(5) A
(6) D
(7) A
(8) B
(9) A
(10) C

(11)

This equations explores the the macroeconomic accounting identity

$$(S - I) = (G - T) + (X - M),$$

where

variable	*definition*
S	total private savings
I	total private investment
G	total government spending
T	tax revenue
X	exports
M	imports

If you understand these relationships and their important implications then you are already more knowledgeable about how the macroeconomy functions than 99% of economists and pundits.

But first, lets derive the equation to better understand its underlying intuition. Let's begin the with well-known macro GDP accounting formula, where GDP (Y), or total income, is equal to

$$Y = C + I + G + X - M, \tag{1}$$

where C is total private consumption (the other variables are the same as above). If we define S as

$$S = Y - C - T$$

and substitute it into equation 1 representing GDP after some rearranging, we find the following:

$$\begin{aligned} Y &= C + I + G + X - M \\ Y - C &= I + G + X - M \\ Y - C - \mathbf{T} &= I + G - \mathbf{T} + X - M \\ S &= I + G - T + X - M \\ (S - I) &= (G - T) + (X - M) \end{aligned}$$

Throughout the question assume $(X - M) = 0$, or that the country in question has no trade surplus or deficit.

(a) If a country experiences a budget deficit, government spending is greater than tax revenue, or $G > T$. By rearranging we see this is equal to $G - T > 0$. This implies

$$\begin{aligned} S - I &= G - T \\ S - I &= G - T > 0 \end{aligned}$$

Therefore, when this occurs in the economy, savings must be greater than investment ($S > I$) or $S - I > 0$. The implication is that whenever a government runs a budget deficit, the private sector must have surplus savings.

(b) If we consider the opposite scenario, a government budget surplus, everything reverses. $G-T < 0$, or $G < T$, which implies

$$S - I = G - T$$
$$S - I = G - T < 0$$

Therefore $S - I < 0$, or $S < I$. By definition, if a government runs a budget surplus then private savings must be less than investment, or be negative.

(12)

If $b^2 - 4ac = 0$, then we have the following result from the quadratic formula:

$$\begin{aligned} x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-b \pm \sqrt{0}}{2a} \\ &= \frac{-b \pm 0}{2a} = \frac{-b}{2a} \end{aligned}$$

Notice, from $b^2 - 4ac = 0$ that

$$\begin{aligned} b^2 &= 4ac \\ \sqrt{b^2} &= \sqrt{4ac} \\ b &= 2\sqrt{ac} \end{aligned}$$

We substitute this into our solution for x, $\frac{-b}{2a}$:

$$\begin{aligned} x &= \frac{-b}{2a} \\ &= \frac{-2\sqrt{ac}}{2a} = -\frac{\sqrt{ac}}{a} \\ &= -\frac{a^{1/2}c^{1/2}}{a} = -a^{-1/2}c^{1/2} \\ x &= -\frac{\sqrt{c}}{\sqrt{a}} = -\sqrt{\frac{c}{a}} \end{aligned}$$

(13) Recall that integers are simply all whole numbers (positive and negative) and zero. The first negative, even integer is therefore -2, the second is -4, the third is -6, and so on. In other words,

$$\{a_1, a_2, a_3, \ldots, a_n\} = \{-2, -4, -6, \ldots, a_n\}.$$

We do not know what n is specifically, but we can tell that this is an arithmetic series. There exists a common difference $d = a_n - a_{n-1}$ between all adjacent terms in the series. In this case $d = -2$.

The sum of n terms in an arithmetic series can be found using $S_n = \frac{n}{2}(a_1+a_n)$. We know how many terms to sum (n), what the first term is ($a_1 = -2$), but do not know the last term (a_n). We must derive a formula using the n^{th} term of an arithmetic sequence formula: $a_n = a_1 + (n-1)d$.

We find that

$$\begin{aligned} a_n &= a_1 + (n-1)d \\ &= -2 + (n-1)(-2) \\ &= -2 - 2n + 2 \\ a_n &= -2n \end{aligned}$$

Now, utilize the sum formula:

$$\begin{aligned} S_n &= \frac{n}{2}(a_1 + a_n) \\ &= \frac{n}{2}(-2 + -2n) \\ &= \frac{n}{2}(1+n)(-2) \\ &= -n(1+n) \\ S_n &= -n - n^2 \end{aligned}$$

(14) Recall that a fiscal multiplier is the ratio of the total economic effect over the initial amount of government spending (g_1), where the total economic effect is the sum of an infinite geometric series:

$$multiplier = \frac{S_\infty}{g_1}.$$

It is feasible to sum an infinite geometric series of additional spending because it is assumed consumers only spend some fraction of their added stimulus, i.e. $r \in (-1, 1)$ and thus each term in the series is small than the previous term.

If

$$multiplier = \frac{S_\infty}{g_1} = 1.15$$

then

$$\begin{aligned} 1.15 &= \frac{S_\infty}{\$25bn} \\ 1.15(\$25bn) &= S_\infty \\ S_\infty &= \$28.75bn \end{aligned}$$

Recall that the sum of an infinite geometric series is $S_\infty = \frac{g_1}{1-r}$. Then, solve for r (where all dollars are in billions):

$$\begin{aligned}
S_\infty &= \frac{g_1}{1-r} \\
\$28.75 &= \frac{\$25}{1-r} \\
\$28.75(1-r) &= \$25 \\
\$28.75 - \$28.75r &= \$25 \\
\frac{-\$28.75r}{-\$28.75} &= \frac{-\$3.75}{-\$28.75} \\
r &= 0.13
\end{aligned}$$

GRADING SCALE

Raw Score	Final Score
32	100
31	99
30	98
29	97
28	96
27	95
26	94
25	93
24	92
23	91
22	90
21	89
20	88
19	87
18	86
17	85
15	83
14	82
10	78
9	77
7.	75