REG-VAR-2425-ASM-SET 1-MATH
Suggested solutions

Multiple Choice Questions

1. C	2. D	3. B	4. B	5. D
6. A	7. A	8. D	9. A	10. B
11. A	12. D	13. D	14. C	15. C
16. D	17. D	18. D	19. B	20. C
21. C	22. B	23. B	24. B	25. C
26. C	27. D	28. C	29. A	30. A

1. C

Let $x + 2y = k(2x - y)$, where k is a non-zero constant.

$$8 + 2(6) = k[2(8) - 6]$$
$$k = 2$$

$$x + 2y = 2(2x - y)$$
$$4y = 3x$$
$$y = \frac{3}{4}x$$

2. D

Let $y = k(x + 2)^2$, where k is a non-zero constant.

$$216 = k(4 + 2)^2$$
$$k = 6$$
$$y = 6(x + 2)^2$$
$$\frac{y}{(x + 2)^2} = 6$$

3. B

Let $y = k\sqrt{x}$, where k is a non-zero constant.

$$10 = k\sqrt{4}$$
$$k = 5$$

When $y = 5$,

$$5 = 5\sqrt{x}$$
$$\sqrt{x} = 1$$
$$x = 1$$

4. B

Let $y = k\sqrt{x}$, where k is a non-zero constant.

$$18 = k\sqrt{81}$$

$$k = 2$$

$2 = 2\sqrt{p}$ and $q = 2\sqrt{121}$

$p = 1$ $= 22$

5. D

Let $y = \dfrac{k}{x^2}$, where k is a non-zero constant.

$$\frac{1}{108} = \frac{k}{12^2}$$

$$k = \frac{4}{3}$$

When $x = 6$,

$$y = \frac{4}{3(6)^2}$$

$$= \frac{1}{27}$$

6. A

Let $y = \dfrac{k}{(x+1)^2}$, where k is a non-zero constant.

$$1 = \frac{k}{(1+1)^2}$$

$$k = 4$$

When $x = 3$,

$$y = \frac{4}{(3+1)^2}$$

$$= \frac{1}{4}$$

7. A

Let $y + 1 = \dfrac{k}{x^2}$, where k is a non-zero constant.

$$224 + 1 = \frac{k}{2^2}$$

$$k = 900$$

When $y = 35$,

$$35 + 1 = \frac{900}{x^2}$$

$$x^2 = 25$$

$x = 5$ or -5 (rejected)

8. D

Let $x = \dfrac{k}{y^2}$, where k is a non-zero constant.

$$1 = \frac{k}{3^2}$$

$$k = 9$$

$$3 = \frac{9}{a^2} \qquad \text{and} \qquad b = \frac{9}{2^2}$$

$$a^2 = 3 \qquad\qquad b = \frac{9}{4}$$

$$a = \sqrt{3} \quad \text{or} \quad -\sqrt{3} \text{ (rejected)}$$

9. A

Let $y = \dfrac{k}{x+2}$, where k is a non-zero constant.

$$3 = \frac{k}{4+2}$$

$$k = 18$$

We have $y = \dfrac{18}{x+2}$.

10. B

Let $y = \dfrac{k}{x-1}$, where k is a non-zero constant.

$$25 = \frac{k}{2-1}$$

$$k = 25$$

When $y = 5$,

$$5 = \frac{25}{x-1}$$

$$x = 6$$

11. A

Let $y = \dfrac{k}{\sqrt[3]{x}}$, where k is a non-zero constant.

$$\frac{7}{3} = \frac{k}{\sqrt[3]{216}}$$

$$k = 14$$

We have $y = \dfrac{14}{\sqrt[3]{x}}$.

12. D

Let $y = \dfrac{k}{\sqrt{x}}$, where k is a non-zero constant.

$$\frac{9}{16} = \frac{k}{\sqrt{4}}$$

$$k = \frac{9}{8}$$

We have $y = \dfrac{9}{8\sqrt{x}}$.

13. D

A. ✓.

B. ✓. $y = \left(\dfrac{1}{4}\right)x$

C. ✓.

D. ✗.

14. C

Let $y = kx^2$, where k is a non-zero constant.

$$x^2 = \frac{y}{k}$$

$$x = \left(\frac{1}{\sqrt{k}}\right)\sqrt{y}$$

x varies directly as $\sqrt{y}$.

15. C

Let $a = \frac{k}{b}$, where k is a non-zero constant.

A. ✓. Since $ab = k$, the statement is true when $k = 1$.

B. ✓. The statement is true when $k = 2$.

C. ✗.

$$\begin{aligned} 2a - 5b &= 0 \\ 2\left(\frac{k}{b}\right) &= 5b \\ 2k &= 5b^2 \\ b^2 &= \frac{2k}{5} \end{aligned}$$

Note that b is not a constant. b^2 cannot equal the constant $\frac{2k}{5}$.

D. ✓.

$$\begin{aligned} 3(ab - 1) &= 1 \\ 3(k - 1) &= 1 \\ k &= \frac{4}{3} \end{aligned}$$

The statement is true when $k = \frac{4}{3}$.

16. D

Let $x = k_1 y^2$ and $y = \frac{k_2}{z^3}$, where k_1 and k_2 are non-zero constants.

$$\begin{aligned} x &= k_1\left(\frac{k_2}{z^3}\right)^2 \\ &= \frac{k_1 k_2^2}{z^6} \end{aligned}$$

Note that $k_1 k_2^2$ is a constant.
We have x varies directly as z^6.

17. D

Let $y = k\sqrt{x}$, where k is a non-zero constant.
The graph of $y = k\sqrt{x}$ has the following properties:

- It is a curve, not a straight line.
- It passes through the origin $(0,\ 0)$.

The answer is D.

18. D

Let $5x - y = k(2x + 3y)$, where k is a non-zero constant.

$$\begin{aligned} 5x - y &= 2kx + 3ky \\ x(5 - 2k) &= (3k + 1)y \\ \frac{x}{y} &= \frac{3k + 1}{5 - 2k} \end{aligned}$$

Thus, $\frac{x}{y}$ is always a constant (except when $k = 2.5$).

19. B

Let $a = kb^2$, where k is a non-zero constant.

Percentage change

$$= \frac{k(0.75b)^2 - kb^2}{kb^2} \times 100\%$$

$$= -43\frac{3}{4}\%$$

20. C

Let $y = \frac{k}{x^2}$, where k is a non-zero constant.

$$\begin{aligned} \frac{y_2}{y_1} &= \frac{1}{(1.25)^2} \\ &= 0.64 \end{aligned}$$

y is decreased by 36%.

21. C

Let $y = \frac{k}{\sqrt{x}}$, where k is a non-zero constant.

Percentage change

$$= \frac{\frac{k}{\sqrt{0.8x}} - \frac{k}{\sqrt{x}}}{\frac{k}{\sqrt{x}}} \times 100\%$$

$$\approx 11.8\%$$

22. B

Let $a = \frac{k}{b}$, where k is a non-zero constant.

Percentage change

$$= \frac{\frac{k}{0.9b} - \frac{k}{b}}{\frac{k}{b}} \times 100\%$$

$$= 11\frac{1}{9}\%$$

23. B

Let $P = k(x - 1)$, where k is a non-zero constant.

$$360 = k(9 - 1)$$
$$k = 45$$

Required profit $= 45(4 - 1)$
$= \$135$

24. B

Surface area $= 4\pi r^2$
$= (4\pi)r^2$
The surface area varies directly as the square of r.

25. C

Let r be the radius of the sphere.
We have $V = \frac{4}{3}\pi r^3$ and $A = 4\pi r^2$.

$$V^2 = \frac{16}{9}\pi^2 r^6$$
$$= \frac{16}{9}\pi^2 \left(\frac{A}{4\pi}\right)^3$$
$$= \frac{16}{9\pi}A^3$$

Thus, $V^2 \propto A^3$.

26. C

x	1	3	4
x^2	1	9	16
y	2	$\frac{2}{9}$	$\frac{1}{8}$

Note that $x^2y = 2$.
We have $y = \frac{2}{x^2}$ and $y \propto \frac{1}{x^2}$.

27. D

x	6	8	12	24
x^2	36	64	144	576
y	16	9	4	1

Note that $x^2y = 576$.
We have $y = \frac{576}{x^2}$ and $y \propto \frac{1}{x^2}$.

28. C

x	2	4	6
x^2	4	16	36
y	6	24	54

Note that $\frac{y}{x^2} = \frac{3}{2}$.

We have $y = \frac{3x^2}{2}$ and $y \propto x^2$.

29. A

The trend goes upwards from left to right.

So, y increases when x increases.

30. A

y remains constant as x and y varies directly as z.

We have $x \uparrow \Rightarrow y$ remains unchanged $\Rightarrow z$ remains unchanged