

REG-CP2A-2324-ASM-SET 2-MATH**Suggested solutions****Multiple Choice Questions**

1. C	2. A	3. D	4. C	5. A
6. A	7. D	8. D	9. B	10. D
11. B	12. B	13. D	14. A	15. C
16. D	17. A	18. D	19. A	20. D
21. A	22. C	23. D	24. A	25. B
26. A	27. D	28. B	29. C	30. C
31. C	32. A	33. D	34. D	35. D
36. B	37. D	38. B	39. A	40. A
41. C	42. B	43. D	44. B	45. B
46. D	47. A	48. B	49. C	50. D
51. B	52. A	53. C	54. B	55. C
56. B	57. A	58. D	59. B	60. D
61. C	62. D	63. C	64. B	65. B
66. D	67. C	68. A	69. A	70. C
71. A	72. A	73. D	74. C	75. C
76. D	77. A	78. C		

1. C

$$(2x - k)^2 - (2x - k)(x - k) = 0$$

$$(2x - k)(2x - k - x + k) = 0$$

$$x = \frac{k}{2} \quad \text{or} \quad 0$$

2. A

$$x^2 + 4x + k = 2$$

$$x^2 + 4x + (k - 2) = 0$$

The equation has two distinct real roots.

$$\Delta = 4^2 - 4(1)(k - 2) > 0$$

$$-4k + 24 > 0$$

$$k < 6$$

3. D

The equation holds for $x = k$.

When $x = k - 1$,

$$\begin{aligned}(x - 1)(x - 2) &= (k - 2)(k - 3) \\ &\neq (k - 1)(k - 2)\end{aligned}$$

When $x = 3 - k$,

$$\begin{aligned}(x - 1)(x - 2) &= (2 - k)(1 - k) \\ &= (k - 1)(k - 2)\end{aligned}$$

Thus, $x = k$ or $3 - k$.

4. C

$$(x - k)^2 = 4k^2$$

$$x - k = \pm 2k$$

$$x = -k \quad \text{or} \quad 3k$$

5. A

β is a root.

$$4\beta^2 - 5\beta - 1 = 0$$

$$4\beta^2 - 5\beta = 1$$

$$7 + 10\beta - 8\beta^2 = 7 - 2(4\beta^2 - 5\beta)$$

$$= 7 - 2(1)$$

$$= 5$$

6. A

β is a root.

$$2\beta^2 - 3\beta - k = 0$$

$$2\beta^2 - 3\beta = k$$

We have $6\beta - 4\beta^2 = -2(2\beta^2 - 3\beta) = -2k$.

$$(6\beta - 4\beta^2)^2 + 2\beta^2 - 3\beta - 14 = 0$$

$$(-2k)^2 + k - 14 = 0$$

$$4k^2 + k - 14 = 0$$

$$k = -2 \quad \text{or} \quad \frac{7}{4}$$

7. D

$$2x^2 + 5x + k - 3 = 0$$

$$\Delta = 5^2 - 4(2)(k - 3) \geq 0$$

$$-8k + 49 \geq 0$$

$$k \leq \frac{49}{8}$$

8. D

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

$$(x - 2a)(a - x - 1) - 3(x - 2a)^2 = 0$$

$$(x - 2a)[(a - x - 1) - 3(x - 2a)] = 0$$

$$(x - 2a)(-4x + 7a - 1) = 0$$

$$x = 2a \quad \text{or} \quad \frac{7a - 1}{4}$$

9. B

$$(x - b)^2 = a^2 - 2ab + b^2$$

$$(x - b)^2 = (a - b)^2$$

$$x - b = \pm(a - b)$$

$$x = a \quad \text{or} \quad -a + 2b$$

10. D

$$x - a = (x - a)(x - b)$$

$$x = a \quad \text{or} \quad 1 = x - b$$

$$x = a \quad \text{or} \quad x = b + 1$$

11. B

Let $BE = x$ cm.

$$AD = \sqrt{100} = 10 \text{ cm}$$

$$42 = 100 - \frac{(10)(10 - x)}{2} - \frac{(x)(x)}{2} - \frac{(10 - x)(10)}{2}$$

$$0 = -\frac{x^2}{2} + 10x - 42$$

$$x = 6 \quad \text{or} \quad 14 \text{ (rejected)}$$

12. B

$$x^2 + ax + (a - 1) = 0.$$

$$\Delta = a^2 - 4(a - 1) = 0$$

$$a^2 - 4a + 4 = 0$$

$$a = 2$$

13. D

$$(x - c)(x - 4c) = (3c - x)(x - 4c)$$

$$(x - 4c)[(x - c) - (3c - x)] = 0$$

$$(x - 4c)(2x - 4c) = 0$$

$$x = 2c \quad \text{or} \quad 4c$$

14. A

$$2x^2 + 8x = p + 5$$

$$2x^2 + 8x - (p + 5) = 0$$

The equation has two distinct real roots.

$$\Delta = 8^2 - 4(2)[-(p + 5)] > 0$$

$$8p + 104 > 0$$

$$p > -13$$

15. C

$$\Delta = k^2 - 4(8k + 36) = 0$$

$$k^2 - 32k - 144 = 0$$

$$k = -4 \quad \text{or} \quad 36$$

16. D

Consider $\begin{cases} 6a - 3b + 9c = 9 \\ 2a + 3b + 5c = 5 \end{cases}$ such that the ratio condition is satisfied.

c is a free variable. Solving the system by putting $c = 2$, we have $a = -\frac{7}{4}$ and $b = -\frac{1}{2}$.

So, $a : b = 7 : 2$.

(Note: you will get $a = b = 0$ if you put $c = 1$. In this case the ratio cannot be obtained. Substitute other values for the answer.)

17. A

$$\frac{3}{2a} = \frac{4}{3b} = \frac{7}{5c} \Rightarrow \frac{\left(\frac{3}{2}\right)}{a} = \frac{\left(\frac{4}{3}\right)}{b} = \frac{\left(\frac{7}{5}\right)}{c}$$

So, $a : b : c = \frac{3}{2} : \frac{4}{3} : \frac{7}{5}$. Since they are positive numbers, $a > c > b$.

18. D

$$\text{Required ratio} = \frac{1}{1 - 30\%} : \frac{1}{1 - 25\%} = 15 : 14$$

19. A

Put $x = 6$. Then $y = 8$ and $z = 3$, and $\frac{y - z}{y + z} = \frac{8 - 3}{8 + 3} = \frac{5}{11}$

20. D

Let $a = 6$, then $b = 3$ and $c = 2$.

$$(a + b) : (b + c) : (c + a) = 9 : 5 : 8$$

21. A

Let the required cost be $\$b/L$.

$$3(42) + 2b = 36(2 + 3)$$

$$b = 27$$

22. C

Let $c = 4$. Then $a = 3$ and $b = 10$.

$$(3a + c) : (a + 3b) = 13 : 33$$

23. D

Let $p = 9k$ and $q = 8k$, where k is a non-zero constant.

$$\frac{3r - p}{q + r} = \frac{3}{23}$$

$$\frac{3r - 9k}{8k + r} = \frac{3}{23}$$

$$69r - 207k = 24k + 3r$$

$$r = \frac{7k}{2}$$

Thus, we have $p : r = 9k : \frac{7k}{2} = 18 : 7$.

24. A

$$3x = 8y$$

$$\frac{3}{\left(\frac{1}{x}\right)} = \frac{8}{\left(\frac{1}{y}\right)}$$

So, $\frac{1}{x} : \frac{1}{y} = 3 : 8$ and only option A satisfies this.

25. B

$$\text{Let } \begin{cases} 2u + 4v = 2 \\ 5u - 2v = 3 \end{cases} \text{ . Then } u = \frac{2}{3} \text{ and } v = \frac{1}{6}.$$

We have $u : v = \frac{2}{3} : \frac{1}{6} = 4 : 1$.

26. A

Compare coefficients of x .

$$2q = r$$

$$\frac{q}{r} = \frac{1}{2}$$

Compare constant term.

$$6p = 5r$$

$$\frac{p}{r} = \frac{5}{6}$$

Thus, $p : q : r = 5 : 3 : 6$.

27. D

$$\text{Let } \begin{cases} 3b - 4c = 1 \\ 4b - 3c = 2 \end{cases} . \text{ Then } b = \frac{5}{7} \text{ and } c = \frac{2}{7}.$$

$$\text{We have } a = c \times \frac{2}{1} = \frac{4}{7}.$$

$$(a + b) : (b + c) = \frac{9}{7} : \frac{7}{7} = 9 : 7$$

28. B

$$\text{Rewrite the equation into } \frac{\left(\frac{7}{11}\right)}{p} = \frac{\left(\frac{11}{13}\right)}{q} = \frac{\left(\frac{13}{17}\right)}{r}$$

$$\text{So, } p : q : r = \frac{7}{11} : \frac{11}{13} : \frac{13}{17} \approx 0.636 : 0.846 : 0.765.$$

Since p , q and r are negative, $q < r < p$

29. C

Let x L be the required amount of water.

$$\frac{2(0.25) + x}{2 + x} = 0.75$$

$$x = 4$$

30. C

Let $y = 20$, then we have $x = 35$ and $z = 16$.

$$\begin{aligned} (x - y) : (y - z) &= (35 - 20) : (20 - 16) \\ &= 15 : 4 \end{aligned}$$

31. C

Let $2p = 4q = 5r = k$, where k is a non-zero constant.

Then $p = \frac{k}{2}$, $q = \frac{k}{4}$ and $r = \frac{k}{5}$.

$$\begin{aligned}(p + q) : (q + r) &= \left(\frac{k}{2} + \frac{k}{4}\right) : \left(\frac{k}{4} + \frac{k}{5}\right) \\ &= \frac{3k}{4} : \frac{9k}{20} \\ &= 5 : 3\end{aligned}$$

Let $2p = 4q = 5r = 20$. Then $p = 10$, $q = 5$ and $r = 4$.

$$\begin{aligned}(p + q) : (q + r) &= (10 + 5) : (5 + 4) \\ &= 5 : 3\end{aligned}$$

32. A

$$\frac{81(5) + x(4)}{5 + 4} = 73$$

$$x = 63$$

33. D

Let $b = 12k$. Then $a = 8k$ and $c = 9k$.

$$k = \frac{87}{12 + 8 + 9} = 3 \text{ and } b = 12(3) = 36$$

34. D

$$\text{Total cost} = 3(22) + 4(36)$$

$$= \$210$$

$$\text{Average cost} = \frac{210}{3 + 4}$$

$$= \$30/\text{kg}$$

35. D

Let $a = 3k$ and $b = 2k$, where k is a non-zero number.

$$5(3k) = 4c$$

$$c = \frac{15k}{4}$$

$$\frac{a + b}{b + c} = \frac{3k + 2k}{2k + \frac{15k}{4}}$$

$$= \frac{20}{23}$$

Alternative solution

Let $a = 12$. Then $b = 8$ and $c = 15$.

$$\frac{a + b}{b + c} = \frac{12 + 8}{8 + 15}$$

$$= \frac{20}{23}$$

36. B

Ratio of number of purple : pink : yellow = 20 : 24 : 9

$$\text{Number of pink dresses} = 15\,741 \times \frac{24}{20 + 24 + 9} = 7128$$

37. D

Let $z = as + \frac{b}{t^2}$, where a and b are non-zero constants.

$$\begin{cases} 13 = a + b \\ -5 = 3a + \frac{b}{4} \end{cases}$$

Solving, we have $a = -3$ and $b = 16$.

$$z = -3(-2) + \frac{16}{(-4)^2} = 7$$

38. B

Let $y = a + bx^2$, where a and b are non-zero constants.

$$\begin{cases} 5 = a + b \\ 8 = a + 4b \end{cases}$$

Solving, we have $a = 4$ and $b = 1$.

When $x = 3$, $y = 4 + 1(3)^2 = 13$.

39. A

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

Percentage change

$$\begin{aligned} &= \frac{\frac{k}{\sqrt[3]{1.08y}} - \frac{k}{\sqrt[3]{y}}}{\frac{k}{\sqrt[3]{y}}} \times 100\% \\ &\approx -2.53\% \end{aligned}$$

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

$$z_r = \frac{k}{\sqrt[3]{1.08}}$$

$$z_r \approx 0.9747$$

Percentage change

$$= (z_r - 1) \times 100\%$$

$$\approx -2.53\%$$

40. A

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

Then $k = \frac{y\sqrt{z}}{x}$.

Therefore, $\frac{x}{y\sqrt{z}} = \frac{1}{k}$ must be a constant.

41. C

Let $z = ay + \frac{b}{y^2}$, where a and b are non-zero constants.

$$\begin{cases} -1 = 2a + \frac{b}{4} \\ 5 = -a + b \end{cases}$$

Solving, we have $a = -1$ and $b = 4$.

When $y = 1$, $z = -1 + \frac{4}{(-1)^2} = 3$

42. B

Let $a = mb^2$ and $\sqrt{b} = \frac{n}{c}$, where m and n are non-zero constants.

Then $c = \frac{n}{\sqrt{b}} = \frac{nm^{\frac{1}{4}}}{a^{\frac{1}{4}}} = \frac{p}{a^{\frac{1}{4}}}$, where $p = nm^{\frac{1}{4}}$ is a constant.

Percentage change = $\frac{\frac{p}{(1.3a)^{\frac{1}{4}}} - \frac{p}{a^{\frac{1}{4}}}}{\frac{p}{a^{\frac{1}{4}}}} \approx -6.35\%$

43. D

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

$$\begin{aligned} z' &= \frac{(1.1)^2}{\sqrt{1 - 0.36}} \\ &= 1.5125 \end{aligned}$$

z is increased by 51.25%.

44. B

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

Then $k = \frac{y\sqrt{w}}{x^2}$.

Thus, $\frac{x^4}{wy^2} = \frac{1}{k^2}$ is a constant.

45. B

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

Percentage change = $\frac{\frac{k(1.35y)}{(1.25x)^2} - \frac{ky}{x^2}}{\frac{ky}{x^2}} \times 100\% = -13.6\%$

46. D

Let $x = \frac{ky^3}{\sqrt{z}}$, where k is a non-zero constant.

$$k = \frac{x\sqrt{z}}{y^3}$$

$$k^2 = \frac{x^2 z}{y^6}$$

$$\frac{y^6}{x^2 z} = \frac{1}{k^2} = \text{constant}$$

47. A

Let $p = \frac{kr}{q^2}$, where k is a non-zero constant.

$$\begin{aligned} \frac{p_2}{p_1} &= \frac{1 - 10\%}{(1 + 20\%)^2} \\ &= 0.625 \end{aligned}$$

p is decreased by 37.5%.

48. B

Let $w = \frac{k\sqrt{u}}{v}$, where k is a non-zero constant. Then $k = \frac{vw}{\sqrt{u}}$.

So, $\frac{wv}{\sqrt{u}} = k$ is a constant.

49. C

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

I. ✗. The statement is false when $k \neq 1$.

II. ✓. $k = \frac{z\sqrt{y}}{x} \Rightarrow \frac{yz^2}{x^2} = k^2 = \text{constant}$

III. ✓. $\frac{0.5z\sqrt{4y}}{x} = \frac{z\sqrt{y}}{x} = k$. The percentage changes are correct.

50. D

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

$$\begin{aligned} \text{Percentage change in } z &= \frac{\frac{k(0.9x)}{(0.75y)^2} - \frac{kx}{y^2}}{\frac{kx}{y^2}} \\ &= +60\% \end{aligned}$$

51. B

Let $p = \frac{ks^2}{t}$, where k is a non-zero constant.

Then $s = \sqrt{\frac{pt}{k}}$.

Percentage change in s

$$= \frac{\sqrt{\frac{(0.25p)(1.44t)}{k}} - \sqrt{\frac{pt}{k}}}{\sqrt{\frac{pt}{k}}} \times 100\%$$

$$= -40\%$$

Let $p = \frac{ks^2}{t}$, where k is a non-zero constant.

$$0.25 = \frac{s_r^2}{1.44}$$

$$s_r = 0.6$$

Thus, s is decreased by 40%.

52. A

Let $c = \frac{ka^2}{b}$, where k is a non-zero constant.

$$\text{Percentage change} = \frac{\frac{k(0.4a)^2}{1.6b} - \frac{ka^2}{b}}{\frac{ka^2}{b}} \times 100\%$$

$$= -90\%$$

53. C

Let $z = \frac{ky}{x^3}$, where k is a non-zero constant.

Then $k = \frac{x^3z}{y}$ is a constant. So, $\frac{y}{x^3z} = k^{-1}$ is also a constant.

54. B

Let $z = \frac{kx^3}{\sqrt{y}}$, where k is a non-zero constant.

Then $k = \frac{\sqrt{y}z}{x^3}$.

So, $\frac{yz^2}{x^6} = k^2$ is a constant.

55. C

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

$$\frac{y_2}{y_1} = \frac{1}{(1.25)^2}$$

$$= 0.64$$

y is decreased by 36%.

56. B

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

$$\text{Percentage change} = \frac{\frac{k(0.88z)}{\sqrt{1.21y}} - \frac{kz}{\sqrt{y}}}{\frac{kz}{\sqrt{y}}} \times 100\%$$

$$= -20\%$$

57. A

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

Then $k = \frac{yz^2}{\sqrt{x}}$ and so $\frac{x}{y^2z^4} = k^{-2}$ is a constant.

58. D

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

$$\frac{4^2(3)}{4} = \frac{9^2(2)}{x}$$

$$x = \frac{27}{2}$$

59. B

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

$$\text{Percentage change} = \frac{\frac{k\sqrt{1.44y}}{(0.8z)^2} - \frac{k\sqrt{y}}{z^2}}{\frac{k\sqrt{y}}{z^2}} \times 100\%$$

$$= 87.5\%$$

60. D

Let $y = ax^3$ and $z = \frac{b}{y^2}$, where a and b are non-zero constants.

$$\text{Then } z = \frac{b}{a^2x^6}$$

I. ✓. $zy^2 = b$ is a constant.

II. ✓. $zx^6 = \frac{b}{a^2}$ is a constant.

III. ✓. $\frac{zy^4}{x^6} = \frac{(zy^2)^2}{zx^6} = \frac{b^2}{\left(\frac{b}{a^2}\right)}$ is a constant.

61. C

$$-2 = 8\left(\frac{1}{2}\right)^3 + a\left(\frac{1}{2}\right)^2 - 5$$

$$a = 8$$

$$\begin{aligned} g(1) &= 8(1)^3 + 8(1)^2 - 5 \\ &= 11 \end{aligned}$$

62. D

$$f(-9) = 2(-9)^2 + 17(-9) + k = 0$$

$$k = -9$$

$$\begin{aligned} \text{Remainder} &= 2\left(\frac{-1}{2}\right)^2 + 17\left(\frac{-1}{2}\right) - 9 \\ &= -17 \end{aligned}$$

63. C

$$\text{Remainder} = f\left(\frac{3}{2}\right)$$

64. B

$$-2 = 2\left(-\frac{1}{2}\right)^3 - 5\left(-\frac{1}{2}\right)^2 - a^2\left(-\frac{1}{2}\right) + a$$

$$0 = \frac{a^2}{2} + a + \frac{1}{2}$$

$$a = -1$$

$$\begin{aligned} \text{Required remainder} &= 2\left(\frac{3}{2}\right)^3 - 5\left(\frac{3}{2}\right)^2 - \left(\frac{3}{2}\right) - 1 \\ &= -7 \end{aligned}$$

65. B

$$4^3 + k(4)^2 + 2k(4) + 8 = 0$$

$$k = -3$$

$$P(x) = x^3 - 3x^2 - 6x + 8$$

By calculator, $P(1) = P(-2) = 0$. So, $(x - 1)(x + 2)$ is a factor of $P(x)$.

Only option B satisfies this.

66. D

$$0 = 3(2)^3 - 5(2)^2 + k(2) + 20$$

$$k = -12$$

67. C

$$0 = f(-3) = 2(-3)^3 + 5(-3)^2 + k$$

$$k = 9$$

$$\text{Remainder} = f(-2) = 2(-2)^3 + 5(-2)^2 + 9 = 13$$

68. A

$$3^3 + a(3)^2 - 3b = 6$$

$$3a - b = -7$$

$$3a - b + 7 = (-7) + 7 = 0$$

69. A

$f(3x - 2)$ is divisible by x .

$$0 = f(0 - 2)$$

$$f(-2) = 0$$

Thus, $f(x)$ is divisible by $x + 2$.

70. C

$$\text{Remainder} = (-1)^{2018} + (-1)^{2017} + (-1)^{2016} + \dots + (-1)$$

$$= (1 - 1) + (1 - 1) \dots + (1 - 1)$$

$$= 0$$

71. A

$$3(2)^2 - 2(2) + k = 0$$

$$k = -8$$

$$3x^2 - 2x - 8 = (x - 2)(3x + 4). \text{ It is also divisible by } 3x + 4.$$

72. A

$$0 = 1^3 + 3(1) - k$$

$$k = 4$$

$$\begin{aligned}\text{Remainder} &= (-2)^3 + 3(-2) - 4 \\ &= -18\end{aligned}$$

73. D

$$0 = k^3 - (k - 1)k^2 + 2k - 3$$

$$0 = k^2 + 2k - 3$$

$$k = -3 \quad \text{or} \quad 1$$

74. C

$$x^2 - x - 12 = (x - 4)(x + 3)$$

Therefore, $(x - 4)$ and $(x + 3)$ are factors of $P(x)$.

$$\text{Thus, } P(4) = P(-3) = 0.$$

75. C

$$0 = k(3)^3 + 2k(3)^2 + 90$$

$$k = -2$$

$$\begin{aligned}\text{Remainder} &= -2(-1)^3 - 4(-1)^2 + 90 \\ &= 88\end{aligned}$$

76. D

$$f(5) = 0 = 2(5)^2 - 13(5) + k$$

$$k = 15$$

$$\begin{aligned}\text{Required remainder} &= f\left(-\frac{1}{2}\right) \\ &= 2\left(-\frac{1}{2}\right)^2 - 13\left(-\frac{1}{2}\right) + 15 \\ &= 22\end{aligned}$$

77. A

$$p(-k) = -k^3 + k^3 - 4k - 16 = 0$$

$$k = -4$$

$$\begin{aligned}\text{Remainder} &= (-2)^3 - 4(-2)^2 + 4(-2) - 16 \\ &= -48\end{aligned}$$

78. C

Let $f(x) = (x - 2)q(x)$, where $q(x)$ is a polynomial.

$f(x - 3) = (x - 5)q(x - 3)$ is divisible by $x - 5$.