REV-MAE-2223-ASM-SET 1-MATH
Suggested solutions

Multiple Choice Questions

1. $\boxed{\text{C}}$

   $bpx^2 + (bq + 1)x + (br + c) = 0$

   $b(px^2 + qx + r) + x + c = 0$

   The roots are the x-coordinates of the intersection of $x + by + c = 0$ and $y = px^2 + qx + r$.
   The roots are x_2 and x_5.

2. $\boxed{\text{C}}$

   $6x + 8 = 4x^2 + 2x - 7$

   $0 = 4x^2 - 4x - 15$

   $x = -1.5 \quad \text{or} \quad 2.5$

   When $x = -1.5$, $y = 6(-1.5) + 8 = -1$; when $x = 2.5$, $y = 6(2.5) + 8 = 23$.
   $(x,\ y) = (-1.5,\ -1)$ or $(2.5,\ 23)$

3. $\boxed{\text{C}}$

   $-4x - 1 = 2x^2 - x - 3$

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

   $x = -2 \quad \text{or} \quad \dfrac{1}{2}$

   When $x = -2$, $y = -4(-2) - 1 = 7$; when $x = \dfrac{1}{2}$, $y = -4\left(\dfrac{1}{2}\right) - 1 = -3$.

   $(x,\ y) = \left(\dfrac{1}{2},\ -3\right)$ or $(-2,\ 7)$

4. $\boxed{\text{C}}$

   $-2x + 7 = x^2 + 4x$

   $0 = x^2 + 6x - 7$

   $x = -7 \quad \text{or} \quad 1$

   When $x = -7$, $y = -2(-7) + 7 = 21$; when $x = 1$, $y = -2(1) + 7 = 5$.

5. $\boxed{\text{B}}$

   $3x^2 - x(7x - 16) = 12$

   $-4x^2 + 16x - 12 = 0$

   $x = 1 \quad \text{or} \quad 3$

   When $x = 1$, $y = 7(1) - 16 = -9$; when $x = 3$, $y = 7(3) - 16 = 5$.

6. $\boxed{\text{A}}$

$$-9x - 7 = x^2 + 6x + 7$$
$$0 = x^2 + 15x + 14$$
$$x = -1 \quad \text{or} \quad -14$$

When $x = -1$, $y = -9(-1) - 7 = 2$; when $x = -14$, $y = -9(-14) - 7 = 119$.

7. $\boxed{\text{D}}$

Put $x = 3y - 1$ into the first equation,

$$(3y - 1)^2 - y(3y - 1) - 3y^2 = 3$$
$$(9 - 3 - 3)y^2 + (-6 + 1)y + (1 - 3) = 0$$
$$y = 2 \quad \text{or} \quad -\frac{1}{3}$$

Only option D satisfies this.

8. $\boxed{\text{B}}$

$$3\left(\frac{4}{3}x + 1\right) = 6x^2 + x - 15$$
$$0 = 6x^2 - 3x - 18$$
$$x = 2 \quad \text{or} \quad -\frac{3}{2}$$

When $x = -\frac{3}{2}$, $y = \frac{4}{3}\left(-\frac{3}{2}\right) + 1 = -1$; when $x = 2$, $y = \frac{4}{3}(2) + 1 = \frac{11}{3}$.

9. $\boxed{\text{C}}$

$$3x - 14 = 2x^2 - 9x + c$$
$$0 = 2x^2 - 12x + (c + 14)$$
$$\Delta = 12^2 - 4(2)(c + 14) = 0$$
$$c = 4$$

10. $\boxed{\text{A}}$

$$mx + 8 = -5x^2 + 2x + 3$$
$$0 = -5x^2 + (2 - m)x - 5$$
$$\Delta = (2 - m)^2 - 4(-5)(-5) = 0$$
$$m^2 - 4m - 96 = 0$$
$$m = 12 \quad \text{or} \quad -8 \text{ (rejected)}$$

When $m = 12$,

$$0 = -5x^2 + (2 - 12)x - 5$$
$$0 = -5x^2 - 10x - 5$$
$$x = -1$$

When $x = -1$, $y = 12(-1) + 8 = -4$.

The solution is $(-1,\ -4)$.

11. $\boxed{\text{B}}$

$$-3x^2 + 8x - 1 = 5x - k$$
$$-3x^2 + 3x + k - 1 = 0$$
$$\Delta = 3^2 - 4(-3)(k-1) \ge 0$$
$$k \ge \frac{1}{4}$$

12. $\boxed{\text{C}}$

$$x^4 - 23x^2 - 50 = 0$$
$$x^2 = 25 \quad \text{or} \quad -2 \text{ (rejected)}$$
$$x = \pm 5$$

13. $\boxed{\text{C}}$

$$(x^2 + 3x)^2 + 6(x^2 + 3x) - 40 = 0$$
$$x^2 + 3x = -10 \quad \text{or} \quad 4$$
$$x^2 + 3x = -10 \qquad \text{or} \qquad x^2 + 3x = 4$$
$$x^2 + 3x + 10 = 0 \qquad\qquad x^2 + 3x - 4 = 0$$
$$\Delta = 3^2 - 4(1)(10) = -31 < 0 \qquad\qquad x = -4 \quad \text{or} \quad 1$$

There are 2 distinct real roots.

14. $\boxed{\text{C}}$

$$x^4 + 21x^2 - 100 = 0$$
$$x^2 = 4 \quad \text{or} \quad -25 \text{ (rejected)}$$
$$x = \pm 2$$

15. $\boxed{\text{D}}$

$$x^6 + 35x^3 + 216 = 0$$
$$x^3 = -8 \quad \text{or} \quad -27$$
$$x = -2 \quad \text{or} \quad -3$$

16. $\boxed{\text{C}}$

$$x - \frac{8}{x-1} = 3$$
$$x(x-1) - 8 = 3(x-1)$$
$$x^2 - 4x - 5 = 0$$
$$x = 5 \quad \text{or} \quad -1$$

17. $\boxed{\text{C}}$

$$(2x+3)\left(1-\frac{5}{x}\right)=-8$$
$$(2x+3)(x-5)=-8x$$
$$2x^2+x-15=0$$
$$x=-3 \quad \text{or} \quad \frac{5}{2}$$

18. $\boxed{\text{A}}$

$$\frac{12}{x^2-9}-\frac{2}{x-3}=1$$
$$12-2(x+3)=(x+3)(x-3)$$
$$0=x^2+2x-15$$
$$x=-5 \quad \text{or} \quad 3$$

19. $\boxed{\text{C}}$

$$\frac{1}{4x-3}-\frac{1}{x-2}=2$$
$$(x-2)-(4x-3)=2(4x-3)(x-2)$$
$$0=8x^2-19x+11$$
$$x=1 \quad \text{or} \quad \frac{11}{8}$$

20. $\boxed{\text{C}}$

$$x-\sqrt{11(x+4)}=-4$$
$$(x+4)^2=(\sqrt{11(x+4)})^2$$
$$x^2+8x+16=11(x+4)$$
$$x^2-3x-28=0$$
$$x=7 \quad \text{or} \quad -4$$

21. $\boxed{\text{D}}$

$$x-8\sqrt{x}+15=0$$
$$\sqrt{x}=3 \quad \text{or} \quad 5$$
$$x=9 \quad \text{or} \quad 25$$

22. $\boxed{\text{B}}$

$$x-\sqrt{3x-5}=5$$
$$(-\sqrt{3x-5})^2=(5-x)^2$$
$$3x-5=x^2-10x+25$$
$$0=x^2-13x+30$$
$$x=10 \quad \text{or} \quad 3 \text{ (rejected)}$$

23. $\boxed{\text{C}}$

$$3^{2x+1} - 4(3^x) + 1 = 0$$
$$3(3^x)^2 - 4(3^x) + 1 = 0$$
$$3^x = \frac{1}{3} \quad \text{or} \quad 1$$
$$x = -1 \quad \text{or} \quad 0$$

24. $\boxed{\text{D}}$

We have $\begin{cases} x^2 - \log y = 4 \\ 2x - \log y^2 = 4 \end{cases}$.

$$\left(\frac{4 + 2\log y}{2}\right)^2 - \log y = 4$$
$$4 + 4\log y + (\log y)^2 - \log y = 4$$
$$(\log y)^2 + 3\log y = 0$$
$$\log y = 0 \quad \text{or} \quad -3$$
$$y = 10^1 \quad \text{or} \quad 10^{-3}$$
$$y = 1 \quad \text{or} \quad \frac{1}{1000}$$

25. $\boxed{\text{D}}$

$$\log_9 y + 2(\log_9 y)^2 = (x - 3) + (4 - x)$$
$$2(\log_9 y)^2 + \log_9 y - 1 = 0$$
$$\log_9 y = -1 \quad \text{or} \quad \frac{1}{2}$$
$$y = \frac{1}{9} \quad \text{or} \quad 3$$

26. $\boxed{\text{A}}$

$$\log_2(2x - 5) = \log_4(35 - 2x)$$
$$\frac{\log(2x - 5)}{\log 2} = \frac{\log(35 - 2x)}{2\log 2}$$
$$\log(2x - 5)^2 = \log(35 - 2x)$$
$$(2x - 5)^2 = 35 - 2x$$
$$4x^2 - 18x - 10 = 0$$
$$x = 5 \quad \text{or} \quad -\frac{1}{2} \text{ (rejected)}$$

27. $\boxed{\text{A}}$

Let $BD = x$ cm.

Then $DE = \frac{42}{x}$ cm.

Since $\triangle EFC \sim \triangle ABC$,

$$\frac{x}{\left(20 - \frac{42}{x}\right)} = \frac{AB}{BC}$$

$$2x = 20 - \frac{42}{x}$$

$$2x^2 - 20x + 42 = 0$$

$$x = 3 \quad \text{or} \quad 7$$

Required length = 3 cm

28. $\boxed{\text{C}}$

Original number of pieces of cake = $\frac{120}{x}$

New number of pieces of cake = $\frac{120}{x-1}$

Therefore, $\frac{120}{x-1} - \frac{120}{x} = 5$.

29. $\boxed{\text{D}}$

$$\frac{x}{x+3} - \frac{x+2}{x+3+5} = \frac{1}{10}$$

$$10x(x+8) - 10(x+2)(x+3) = (x+3)(x+8)$$

$$-x^2 + 19x - 84 = 0$$

$$x = 7 \quad \text{or} \quad 12$$

30. $\boxed{\text{A}}$

Let the required number be n.

$$\frac{840}{2.25(n-6)} - \frac{840}{2.25n} = 8$$

$$840n - 840(n-6) = 18n(n-6)$$

$$0 = 18n^2 - 108n - 5040$$

$$n = 20 \quad \text{or} \quad -14 \text{ (rejected)}$$

END OF PAPER