Ch.3 Quadratic Equations in One Unknown
Multiple Choice Question

[19-20]

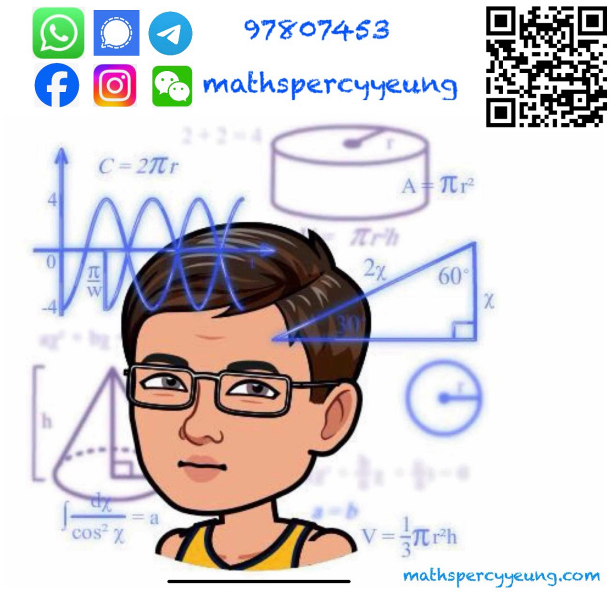
1. [19-20 Standardized test 1, #5]
A car travels for x hours at a constant speed of $(4x - 4)$ km/h. If the distance travelled is 80 km, find the value of x.

A. 5

B. 4

C. 2

D. 1



2. [19-20 Standardized test 1, #7]
Solve $(2x+5)(x-2)=(2x+5)(4-x)$.

A. $x=-\frac{5}{2}$

B. $x=3$

C. $x=-\frac{5}{2}$ or $x=3$

D. $x=\frac{5}{2}$ or $x=3$

3. [19-20 Standardized test 1, #8]
If the equation $x^2-2x+8=-k$ has real roots, where k is an integer, find the maximum possible value of k.

A. –8
B. –7
C. 7
D. 8

4. [19-20 Mid-year, #8]
If the equation $2x^2-3x+k=0$ has no real roots, find the range of values of k.

A. $k>-\frac{9}{8}$ **B.** $k<-\frac{9}{8}$

C. $k<\frac{9}{8}$ **D.** $k>\frac{9}{8}$

5. [19-20 Mid-year, #11]

Solve $(x+2)(x-2)=2-x$.

A. $x=-3$ **B.** $x=-2$

C. $x=-3$ or $x=2$ **D.** $x=-2$ or $x=2$

6. [19-20 Mid-year, #12]

If $a^2-4b^2=0$ and $ab<0$, then $\frac{a}{b}=$

A. -2. **B.** -0.5.

C. 0.5. **D.** 2.

7. [19-20 Mid-year, #14]

If α and β are the roots of the equation $x^2-ax+b=0$, which of the following equation whose roots are -2α and -2β?

A. $x^2+2ax-4b=0$ **B.** $x^2+2ax+4b=0$

C. $4x^2+2ax-b=0$ **D.** $4x^2+2ax+b=0$

8. [19-20 Mid-year, #17]

A stone is thrown vertically upwards. After t seconds, its height (h m) above the ground is given by $h=6t-t^2+7$. Which of the following statements is/are true?

I. The initial height of the stone from the ground is 7 m.

II. The maximum height that the stone can reach is 6 m.

III. After 7 seconds, the stone will reach the ground.

A. I only **B.** I and II only

C. I and III only **D.** II and III only

9. [19-20 Mid-year, #19]

Consider the quadratic equation $bx^2+ax-b=0$, where a and b are real numbers. The equation must have

A. two distinct rational roots. **B.** two distinct real roots.

C. two repeated real roots when $a=2b$. **D.** no real roots.

[20-21]

10. [20-21 Mid-year, #3]

Solve $5(x-2) = (x-2)^2$.

A. $x = 2$

B. $x = 7$

C. $x = 2$ or 3

D. $x = 2$ or 7

11. [20-21 Mid-year, #4]

If the graph of $y = -2x^2 - 3x - k$ has two x-intercepts, find the range of the values of k.

A. $k > -\frac{9}{8}$
B. $k < -\frac{9}{8}$
C. $k > \frac{9}{8}$
D. $k < \frac{9}{8}$

12. [20-21 Mid-year, #8]

The quadratic equation $x^2 - 3x + 6 - 2k = -kx$ has one double real root. Find the value(s) of k.

A. $k = \frac{15}{8}$
B. $k = -15$ or $k = 1$
C. $k = -5$ or $k = 3$
D. $k = 3 \pm 2\sqrt{6}$

13. [20-21 Mid-year, #9]

If $\alpha \neq \beta$ and $\begin{cases} \alpha^2 - 3\alpha - 2 = 0 \\ \beta^2 - 3\beta - 2 = 0 \end{cases}$, then $\alpha + \beta =$

A. -3.
B. -2.
C. 2.
D. 3.

14. [20-21 Mid-year, #10]

The hypotenuse of a right-angled triangle is $(23 - 2x)$cm. The other two sides of the triangle are $(x + 12)$cm and 8 cm respectively. Find the value(s) of x.

A. $x = 1$

B. $x = 3$

C. $x = \frac{107}{3}$

D. $x = 3$ or $\frac{107}{3}$

15. [20-21 Final Exam, #4]

Solve the equation $(x + 2)x = 5(x + 2)$.

A. $x = -2$
B. $x = -2$ or 5
C. $x = 5$
D. $x = 2$ or 5

16. [20-21 Final Exam, #5]

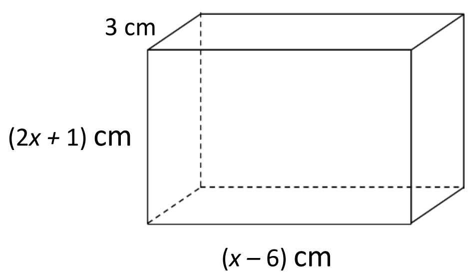
The graph of $y = x^2 - 6x + (k - 2)$ has no x-intercepts. Find the range of values of k.

A. $k > 7$
B. $k < 7$
C. $k > 11$
D. $k < 11$

17. [20-21 Final Exam, #9]

The figure shows a solid metallic cuboid. If the volume of the cuboid is 102 cm^3, find the value of x.

A. $x = 8.06$
B. $x = 8.06$ or -2.23
C. $x = 8$
D. $x = 8$ or -2.5



18. [20-21 Final Exam, #19]

It is given that -4 is a root of the quadratic equation $(x + k)^2 + x - 5 = 0$, where k is a constant. Find k.

A. -1 or 1
B. -1 or 5
C. 1 or 5
D. 1 or 7

19. [20-21 S.5 Final Exam, #5]

If $a = 2b$ where a and b are non-zero real constants, find the number of real roots of the equation $x^2 - 2bx + a^2 = 0$.

A. 0
B. 1
C. 2
D. 3

20. [20-21 S.5 Final Exam, #6]

Let a be a constant. Solve the equation $(x-a)^2 = a - x$.

A. $x = a - 1$
B. $x = a$
C. $x = a$ or $x = a - 1$
D. $x = a$ or $x = a + 1$

[21-22]

21. [21-22 Mid-year, #6]

Solve $(x+1)(x-8) = x+1$.

A. $x = 8$
B. $x = 9$
C. $x = -1$ or 8
D. $x = -1$ or 9

22. [21-22 Mid-year, #7]

Solve the equation $2x(x+4) = 3 - x$.

A. $x = \dfrac{-9 \pm \sqrt{57}}{4}$
B. $x = \dfrac{-9 \pm \sqrt{57}}{2}$
C. $x = \dfrac{-9 \pm \sqrt{105}}{4}$
D. $x = \dfrac{-9 \pm \sqrt{105}}{2}$

23. [21-22 Mid-year, #8]

If k is a constant such that the equation $2x^2 + 2x + 8 - k = 0$ has equal roots, find the value of k.

A. $-\frac{17}{2}$
B. $-\frac{15}{2}$
C. $\frac{15}{2}$
D. $\frac{17}{2}$

24. [21-22 Mid-year, #9]

Which of the following quadratic equations can be formed by the roots $(k+1)$ and $(k-1)$, where $k \neq 0$?

A. $x^2 + 2kx - (k^2 - 1) = 0$
B. $x^2 - 2kx + (k^2 - 1) = 0$
C. $x^2 - 2kx + (k^2 + 1) = 0$
D. $x^2 + 2kx - (k^2 + 1) = 0$

25. [21-22 Mid-year, #16]

It is given that the area of a right-angled triangle is 60 cm^2. If the base is 7 cm longer than the height. Find the perimeter of the right-angled triangle.

A. 30 cm
B. 35 cm
C. 40 cm
D. 45 cm

26. [21-22 Mid-year, #17]

Determine the nature of the roots of the equation $(k+1)x^2 + 3kx - k - 3 = 0$ where k is a positive constant.

A. No real roots
B. One double real root
C. Two unequal real roots
D. It cannot be determined

27. [21-22 Mid-year, #18]

It is given that α and β are the roots of the quadratic equation $x^2 - 8x + 2 - m = 0$. If the square of the product of roots is two times the sum of roots, then m =

A. –2 or 6 .
B. 0 or 4 .
C. –6 or 2 .
D. 6

28. [21-22 Final Exam, #6]

If the sum and the product of two numbers are –7 and 12 respectively, the smaller number is

A. – 4.
B. – 3.
C. 3.
D. 4.

29. [21-22 S.5 Final Exam, #7]

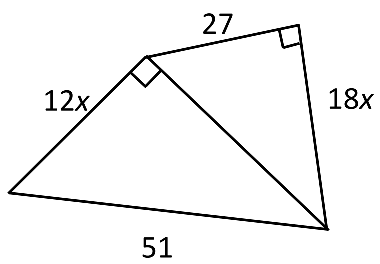
If k is an integer such that the quadratic equation $x^2 + 2x + 2k - 1 = 0$ has two distinct real roots, find the largest value of k.

A. 1
B. 0
C. – 1
D. – 2

30. [21-22 S.6 Standardized Test, #8]

In the figure, find the value of x.

A. 2
B. 4
C. 8
D. 16



31. [21-22 S.6 Mock, #6]

If k is a constant such that the quadratic equation $4x^2 + 2kx + k + 8 = 0$ has equal roots, then $k =$

A. –4.
B. 8.
C. –4 or 8.
D. –2 or 1.

32. [21-22 S.6 Mock, #33]

If $m \neq n$ and $3m^2 + 2m = 3n^2 + 2n = 9$, then $9m^2 + mn - 6n =$

A. 19.
B. 26.
C. 28.
D. 34.

33. [21-22 S.6 Final, #5]

If α is a root of the equation $2x^2 - 6x + 15 = 0$, then $10 - 6\alpha^2 + 18\alpha =$

A. –35.
B. 5.
C. 15.
D. 55.

[22-23]

34. [S.4 22-23 Mid-Year,#2]

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

A. $(a+b)(3a-b)$.
B. $(a-b)(3a+b)$.
C. $(a+3b)(3a-b)$.
D. $(a-3b)(3a+b)$.

35. [S.4 22-23 Mid-Year,#8]

Solve the equation $(x-3)(x-4)=x-3$.

A. $x=4$

B. $x=3$

C. $x=3$ or $x=4$

D. $x=3$ or $x=5$

36. [S.4 22-23 Mid-Year,#13]

The sum of the square of two consecutive positive integers is 1985. Find the sum of these two numbers.

A. 61

B. 63

C. 65

D. 67

37. [S.4 22-23 Mid-Year,#14]

Let k be a constant. If the quadratic equation $2kx^2-kx=2x-1$ has equal roots, then $k=$

A. 2.

B. 1.

C. –1.

D. –2.

38. [S.4 22-23 Mid-Year,#17]

If $p\neq q$ and $2p^2-3p=2q^2-3q=-4$, then $(p-4)(q-4)=$

A. 2 .

B. 12 .

C. 14 .

D. 24 .

39. [S.4 22-23 Mid-Year,#18]

If α is a root of the equation $3x^2 + 4x - 5 = 0$, then $15 - 8\alpha - 6\alpha^2 =$

A. 5 .
B. 10 .
C. 15 .
D. 20 .

40. [S.4 22-23 Standardized Test,#6]

Solve $4x + 11\sqrt{x} - 3 = 0$.

A. $x = \frac{1}{16}$
B. $x = \frac{1}{2}$
C. $x = 9$
D. $x = 9$ or $x = \frac{1}{16}$

41. [S.4 22-23 Final,#6]

Let a be a constant. Solve the equation $(x - 2a)(x + 3a) = (x + 3a)(4a - x)$.

A. $x = a$
B. $x = 3a$
C. $x = -a$ or $x = 3a$
D. $x = -3a$ or $x = 3a$

42. [S.4 22-23 Final,#7]

Find the range of values of h such that the quadratic equation $x^2 + 4x = 3 - h$ has two distinct real roots.

A. $h > -7$
B. $h \geq -7$
C. $h < 7$
D. $h \leq 7$

43. [S.4 22-23 Final,#10]

If the simultaneous equations $\begin{cases} y = -x^2 + 10x - k \\ y = 2x + k \end{cases}$ have only one solution, then $k =$

A. –25.
B. –8.
C. 8.
D. 25.

44. [S.4 22-23 Final,#14]

If $\sqrt{16-5x} = 2 - x$, then $x =$

A. –4.
B. 3.
C. –3 or 4.
D. –4 or 3.

45. [S.4 22-23 Final,#24]

If α and β are the roots of the equation $5x^2 - kx - 1 = 0$, where k is a constant, then $5\alpha^2 + k\beta =$

A. 1.
B. $\frac{k^2}{5}$.
C. $\frac{5-k^2}{5}$.
D. $\frac{k^2+5}{5}$.

46. [S.5 22-23 Mid-year,#8]

Let m be a constant. If the quadratic equation $x^2 - mx + 22 = 2x + m$ has equal roots, then $m =$

A. -14 or 6.
B. -12 or 8.
C. -8 or 12.
D. -6 or 14.

47. [S.5 22-23 Final,#3]

If $x^2 - 8x + 3 \equiv (-x + a)^2 + b$, then $a + b =$

A. –23.
B. –17.
C. –9.
D. 3.

48. [S.5 22-23 Final,#5]

Let $f(x) = -x^2 + 5x - 2k$, where k is a constant. If the equation $f(x) = 0$ has no real roots, find the smallest integral value of k.

A. 2
B.4
C. 6
D. 8

49. [S.5 22-23 Final,#6]

If $\square$ is a root of the equation $x^2 - 2x + 5 = 0$, then $-2\alpha^2 + 4\alpha + 5 =$

A. –2.
B.0.
C. 5.
D. 15.

50. [S.6 22-23 Timed Practice 4,#8]

If k is a constant such that the quadratic equation $x^2 - 6x = k(x - 8)$ has equal roots, then $k =$

A. 2 or 18. **B.** –6 or 8.
C. –6 or 2. **D.** –6 or 0.

51. [S.6 22-23 Timed Practice 6,#6]

If β is a root of $3x^2 - 8x + 2 = 0$, then $3 + 16\beta - 6\beta^2 =$

A. –1.
B. 1.
C. 5.
D. 7.

52. [S.6 22-23 Timed Practice 6,#33]

If k is a constant and $\alpha \neq \beta$ such that $\begin{cases} 16^{\alpha} - 4^{\alpha+2} = -k \\ 16^{\beta} - 4^{\beta+2} = -k \end{cases}$, then $\alpha + \beta =$

A. $2k$.
B. k.
C. $\log_4 2k$.
D. $\log_4 k$.

53. [22-23 S6 Mock,#6]

If α is a root of the equation $(4x - 3)x = 2$, then $6\alpha - 8\alpha^2 + 5 =$

A. -9.
B. -1.
C. 1.
D. 9.

54. [22-23 S6 Mock,#33]

If $p \neq q$ and $p^2 + p = q^2 + q = -5$, then $\frac{1}{p} + \frac{1}{q} =$

A. -5.
B. $-\frac{1}{5}$.
C. $\frac{1}{5}$.
D. 5.

[23-24]

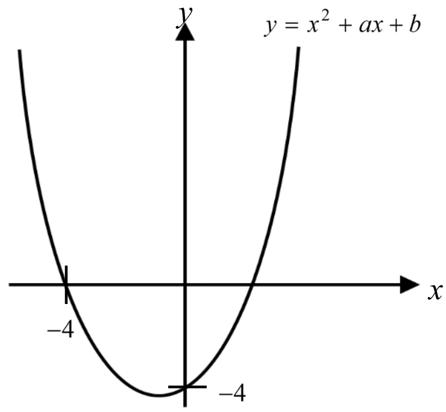
55. [S.4 23-24 Mid-Year,#9]

Solve $(t+3)(2t-5) = -2(t+3)$.

A. $t = -3$
B. $t = \frac{3}{2}$
C. $t = -\frac{3}{2}$ or 3
D. $t = \frac{3}{2}$ or -3

56. [S.4 23-24 Mid-Year,#10]

The figure shows the graph of $y = x^2 + ax + b$, where a and b are constants. Find the value of *a*.



A. −4.
B. −3.
C. 2.
D. 3.

57. [S.4 23-24 Mid-Year,#11]

If the quadratic equation $x^2 - 5x - k - 3 = 0$ has real roots, then the range of values of *k* is

A. $k > -\frac{37}{4}$.
B. $k \geq -\frac{37}{4}$.
C. $k < \frac{13}{4}$.
D. $k \leq \frac{13}{4}$.

58. [S.4 23-24 Mid-Year,#13]

If the sum of the squares of two consecutive positive numbers is less than the square of the sum of that two numbers by 24, then the smaller number is

A. 1.
B. 2.
C. 3.
D. 4.

59. [S.4 23-24 Mid-Year,#16]

Let $f(x) = ax^2 + 2x - 3a^2$, where $a > 0$. The graph of $y = f(x)$ cuts the *x*-axis at point *A* and *B*. It passes through $(-1, -4)$ and cuts the *y*-axis at point *C*. The area of ΔABC is

- **A.** 5 square units.
- **B.** 6 square units.
- **C.** 10 square units.
- **D.** 12 quare units.

60. [S.4 23-24 Mid-Year,#17]

If $\alpha \neq \beta$ and $\begin{cases} \alpha^2 - 8 = 3\alpha \\ \beta^2 - 8 = 3\beta \end{cases}$, then $\alpha\beta =$

- **A.** -8.
- **B.** -3.
- **C.** 3.
- **D.** 5.

61. [S.4 23-24 Final,#19]

If $g \neq h$ and $g^2 + 5g = h^2 + 5h = 8$, then $g^2 + h^2 =$

- **A.** -9.
- **B.** 9.
- **C.** 41.
- **D.** 64.

62. [S.5 23-24 mid-year,#7]

Let *k* be a constant. Solve the equation $(x+k)(x-k) = x - k$.

- **A.** $x = -k$ or $x = 1 + k$
- **B.** $x = -k$ or $x = 1 - k$
- **C.** $x = k$ or $x = 1 + k$
- **D.** $x = k$ or $x = 1 - k$

63. [S.5 23-24 mid-year,#26]

If $\alpha \neq \beta$ and $\begin{cases} \alpha^2 + 4\alpha = k \\ \beta^2 + 4\beta = k \end{cases}$, where k is a constant, then $\alpha^2 + \beta^2 =$

A. $16 - k$.
B. $16 + k$.
C. $16 - 2k$.
D. $16 + 2k$.

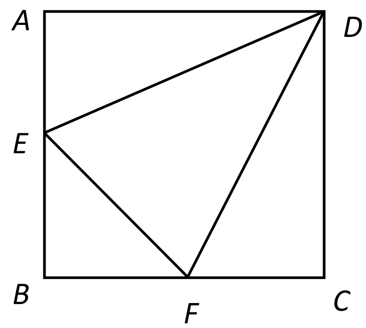
64. [S.5 23-24 Final,#5]

Let k be a constant. Solve the equation $(x+k)(x-5k) = (x-5k)(4k-x)$.

A. $x = -k$
B. $x = 5k$
C. $x = -k$ or $x = 4k$
D. $x = \dfrac{3k}{2}$ or $x = 5k$

65. [S.5 23-24 Final,#19]

In the figure, the area of the square $ABCD$ is 100 cm^2. If $BE = BF$ and the area of ΔDEF is 42 cm^2, then BE =



A. 5 cm.
B. 6 cm.
C. 7 cm.
D. 8 cm.

66. [S.6 23-24 Timed Practice 4,#29]

If the equation $x^2 - 6x + 9 = kx$ has real roots, then

A. $k \geq -12$.

B. $k > 0$.

C. $-12 \leq k \leq 0$.

D. $k \leq -12$ or $k \geq 0$.

67. [S.6 23-24 Timed Practice 4,#32]

If $\alpha \neq \beta$ and $\begin{cases} \alpha^2 - 3\alpha + 5 = 0 \\ \beta^2 - 3\beta + 5 = 0 \end{cases}$, then $\alpha^3 + \beta^3 =$

A. -18 .
B. -9 .
C. 12 .
D. 72 .

68. [S.6 23-24 Timed Practice 6,#4]

If $(x-5)(x-6) = (c-5)(c-6)$, find x.

A. 5 or 6
B. c or 5
C. c or 6
D. c or $11-c$

~End~

Quadratic Equations
Conventional Questions

[19-20]

1. **[19-20 Standardized test 1, #2]**
It is given that $5x^2+6x-4p=0$ has no real roots. Find the range of values of *p*. **(3 marks)**

2. **[19-20 Standardized test 1, #5]**
It is given that ΔABC is a right angled triangle where the length of the hypotenuse is $5-2x$ and the lengths of the other two sides are $9+x$ and 12 respectively. Find the value(s) of *x*. **(2 marks)**

3. **[19-20 Standardized test 1, #6]**
It is given that α and β are the roots of the equation $2x^2-8x+1=0$.

Without solving for the values of α and β,

(a) write down the value of $\alpha+\beta$ and $\alpha\beta$, **(1 mark)**

(b) form a quadratic equation in *x* such that its roots are $\frac{2}{\alpha^2}$ and $\frac{2}{\beta^2}$. **(3 marks)**

4. **[19-20 Standardized test 1, #7]**
In **Figure 1**, *ABCD* is a rectangle. *E* is a point on *BC* such that $\Delta ABE \sim \Delta ECD$. If *AB* = *k*, *CE* = 4 and *AD* = *k* + 9, where *k* is a non-zero constant, find the value(s) of *k*. Give your answer(s) in surd form if necessary. **(3 marks) (Lv 3)**

It is given that *α* and *β* are the roots of the quadratic equation $3x^2+9x-2=0$.

5. **[19-20 Mid-year, #11]**

(a) Without solving the quadratic equation, find the values of

(i) $\left(1+\frac{1}{\alpha}\right)\left(1+\frac{1}{\beta}\right)$, and

(ii) $\alpha^2+\beta^2$. **(5 marks)**

(b) Form a quadratic equation in *x* with roots $\left(1+\frac{1}{\alpha}\right)\left(1+\frac{1}{\beta}\right)$ and $\alpha^2+\beta^2$. **(2 marks)**

6. [19-20 Mid-year, #14]

(a) Solve $2x^2+\sqrt{12}x-3=0$ and express the answers in surd form. **(2 marks)**

(b) Hence, or otherwise, solve $2\left(\frac{y-\sqrt{3}}{2}\right)^2+\sqrt{12}\left(\frac{y-\sqrt{3}}{2}\right)-3=0$. **(2 marks)**

7. [19-20 Mid-year, #15]

Let $f(x)=3x^2+(6-6k)x+4k^2-6k+5$, where *k* is a real constant.

(a) Does the graph of $y=f(x)$ touch the *x*-axis? Explain your answer. **(3 marks)**

(b) Using the method of completing the square, express the coordinates of the vertex of the graph of $y=f(x)$ in terms of *k*. **(3 marks)**

8. [19-20 Mid-year, #16]

Solve $x^2+nx+x=2n^2+n$, where *n* is a constant. Express your answers in terms of *n*. **(3 marks)**

[20-21]

9. [20-21 Mid-year, #2]

Solve $2(3x-1)=3(x+1)$. Leave your answer in surd form if necessary. **(3 marks)**

10. [20-21 Mid-year, #4]

α and β are roots of quadratic equation $2x2+3x+7=0$.

(a) Write down the values of $\alpha+\beta$ and $\alpha\beta$. **(1 mark)**

(b) Form a quadratic equation in x with roots $\frac{1}{2\alpha}$ and $\frac{1}{2\beta}$ **(3 marks)**

11. [20-21 Mid-year, #6]

In **Figure 2**, $ABCD$ is a rectangle, with $AB=6$ cm and $BC=8$ cm. ΔDEF is cut away from the rectangle, where $ED=(x+1)$ cm and $DF=x$ cm. If the area of $ABCFE$ is 43.625 cm^2, find the value of x. **(3 marks)**

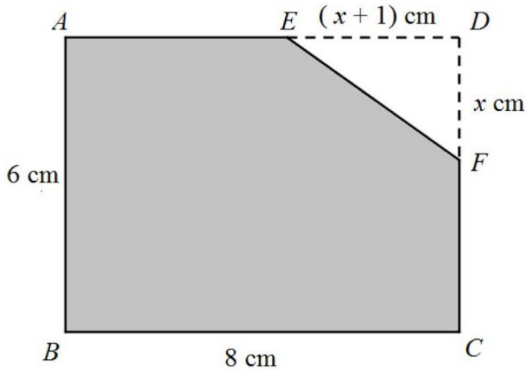


Figure 2

12. [20-21 Final Exam, #10]

If $\frac{1}{\alpha}$ and $\frac{1}{\beta}$ are the roots of the quadratic equation $3x^2 - 6x - 1 = 0$,

(a) find the values of $\alpha\beta$ and $\alpha + \beta$, and **(3 marks)**

(b) form a quadratic equation in x whose roots are $4\alpha^2$ and $4\beta^2$. **(3 marks)**

[21-22]

13. [21-22 Mid-year, #5]

It is given that -5 is a root of the equation $2x^2 + 7x + k = 0$, where k is a constant.

(a) Find the value of k. **(2 marks)**

(b) Find the other root of the equation. **(1 marks)**

14. [21-22 Mid year, #8]

It is given that the quadratic equation $(x-1)(x-3) + k = 0$, where k is a constant, has two distinct real roots.

(a) Find the range of values of k. **(3 marks)**

(b) Hence, find the roots of the equation for the largest integral value of k in **(a)**. **(2 marks)**

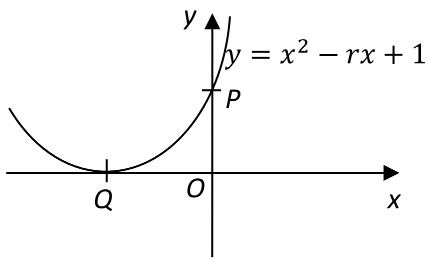
15. [21-22 Mid-year, #13]

Figure 3 shows the graph of $y = x^2 - rx + 1$, where r is a constant.

The graph intersects the y-axis at P and touches the x-axis at Q.

(a) Find the value of r. **(2 marks)**

(b) Find the area of ΔOPQ. **(2 marks)**



16. [21-22 Mid-year, #15]

Figure 4 shows the graph of $y = x^2 + 3kx + 27$. It cuts the x-axis at the points $A\ (\alpha, 0)$ and $B\ (\beta, 0)$. It is given that $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{8}{9}$.

(a) Find the value of k. **(3 marks)**

(b) A student claims that the roots of $x^2 + 3kx + 27 = 0$ are irrational. Do you agree? Explain your answer. **(2 marks)**

(c) Without using a calculator, find the value of $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$. **(3 marks)**

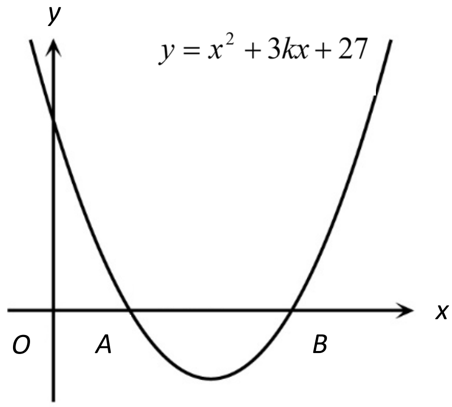


Figure 4

17. [21-22 Final, #9]

It is given that the graph of $y = 6x^2 + 5x + k$, where k is a real constant, cuts the x-axis at two distinct points P and Q.

(a) Find the range of values of k. **(3 marks)**

(b) Figure 1 shows the graph of $y = 6x^2 + 5x + k$. The graph cuts the y-axis at R. Take the largest possible non-positive integral value of k, find the area of ΔPQR. **(2 marks)**

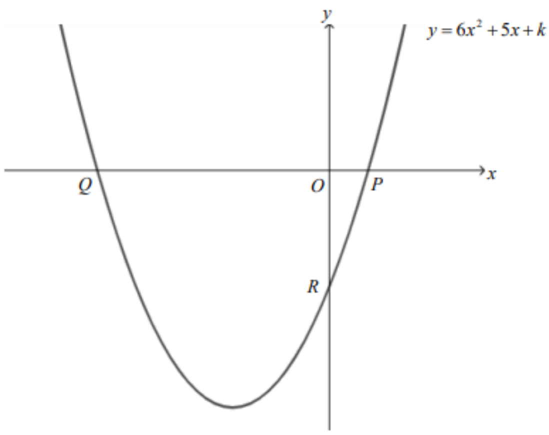


Figure 1

18. [21-22 S.5 Final Exam, #10]

It is given that $x^2 + 8x + 4k = 0$ has two equal roots.

(a) Find the value of k. **(3 marks)**

(b) By using the value of k in **(a)**, find the value of $\alpha^2 + \beta^2$ if α and β are roots of $2x^2 + kx + 9 = 0$. **(3 marks)**

19. [21-22 Final, #11]

A wire of length 52 cm is bent into a rhombus $ABCD$. The diagonal AC and BD intersect at E. It is given that $AC = \frac{2}{x}$ cm and $BD = [\frac{8}{x} - 16]$ cm, where $x > 0$. Find the area if the rhombus.

(5 marks)

[22-23]

20. [S.4 22-23 Mid-Year,#5]

In a right-angled triangle, the longest side is $(2s+5)$ cm. The lengths of the other sides are $(9-s)$ cm and 12 cm. Find *s*. **(3 marks)**

21. [S.4 22-23 Mid-Year,#6]

It is given that $f(x) = a(2x+1)(2x-1)+b$. If $f(0)=2$ and $f(1)=6$, find *a* and *b*. **(4 marks)**

22. [S.4 22-23 Mid-Year,#9]

Let *k* be a constant. It is given that the graph of $y = 2x^2 - 3x + k$ is always above the *x*-axis.

(a) Find the range of values of *k*. **(3 marks)**

(b) Taking the minimum integral value of *k* found in **(a)**, the graph of $y = 2x^2 - 3x + k - 4$ cuts the *x*-axis at *A* and *B* while it cuts the *y*-axis at *C*. Find the area of Δ*ABC*. **(3 marks)**

23. [S.4 22-23 Mid-Year,#11]

It is given that $\alpha+1$ and $\beta+1$ are the roots of the equation $x^2+2x+3=0$.

(a) Find $\alpha+\beta$ and $\alpha\beta$. **(2 marks)**

(b) Let $f(x) = x^2 + px + q$ such that α^2 and β^2 are roots of $f(x)=0$.

(i) Find the values of *p* and *q*.

(ii) Let *r* be a constant. If $f(x) = r$ has real roots, find the least value of *r*. **(5 marks)**

24. [S.4 22-23 Final,#4]

The quadratic equation $kx^2 - (k-6)x - 8 = 0$ has two equal real roots.

(a) Find the values of *k*.

(b) By using the smaller value of *k* in **(a)**, write down the root of the equation. **(4 marks)**

25. [S.4 22-23 Final,#5]

If $f(x) = ax^2 + b$ and $6f(1) = f(2) = 18$,

(a) find the values of *a* and *b*.

(b) Write down the product of roots of the equation $f(x) = 10x + 1$.

(4 marks)

26. [S.4 22-23 Final,#10]

It is given that the difference between the two roots of the equation $4x^2 - 8x + k = 0$ is 5. Find

(a) the roots of the equation, and **(2 marks)**

(b) the value of *k*. **(2 marks)**

27. [S.5 22-23 Mid-year,#20]

Let $\mathrm{f}(x) = (x+9)^2 + h$ and $\mathrm{g}(x) = x^2 - 8kx - 6x + 16k^2 + 26k + 8$, where *h* and *k* are constants. On the same rectangular coordinate system, denote the vertex of the graph of $y = \mathrm{f}(x)$ and the vertex of the graph of $y = \mathrm{g}(x)$ by *P* and *Q* respectively.

(a) Using the method of completing the square, express, in terms of *k*, the coordinates of *Q*. **(2 marks)**

(b) If *PQ* = 12 units and *P* is vertically above *Q*, find the *y*-intercept of the graph of $y = \mathrm{f}(x)$. **(3 marks)**

28. [S.5 22-23 Final,#10]

Let $\mathrm{p}(x) = -x^2 + 4x + 6k$, where *k* is a constant. The equation $\mathrm{p}(x) = 0$ has equal roots.

(a) Find *k*. **(2 marks)**

(b) Write down the *y*-intercept of the graph of $y = \mathrm{p}(x)$. **(1 mark)**

(c) Find the *x*-intercept(s) of the graph of $y = \mathrm{p}(x) + 16$. **(3 marks)**

[23-24]

29. [S.4 23-24 Mid-Year,#9]

In **Figure 1**, *ABCD* is a trapezium with *AD* // *BC*, $\angle ADC = \angle BCD = 90°$, *AB* = (10 − *x*) cm, $BC = (6 - 2x)$ cm, $CD = (3 - 3x)$ cm and $AD = (10 + x)$ cm. If the area of trapezium *ABCD* is $114\ \text{cm}^2$, find the perimeter of the trapezium. **(4 marks)**

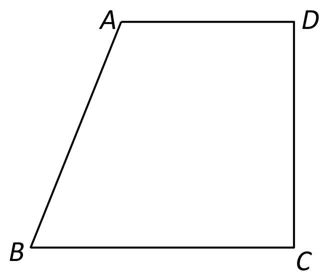


Figure 1

30. [S.4 23-24 Mid-Year,#13]

Let *h* be a real constant. Suppose α and β are the roots of the quadratic equation $3x^2 + hx + 12 = 0$ such that $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{5}{12}$.

(a) Find the value of *h*. **(2 marks)**

(b) Alvin claims that the quadratic equation $(\alpha^2 + \beta^2)x^2 + x - 3 = 0$ has no real roots. Do you agree? Explain your answer. **(3 marks)**

31. [S.4 23-24 Final,#7]

Let *k* be a constant. It is given that the quadratic equation $x^2 + 3kx + 3k - 1 = 0$ has equal roots.

(a) Find the value of k.

(b) Solve $x^2 + 3kx + 3k - 1 = 0$. **(4 marks)**

32. [S.5 23-24 Mid-year,#7]

Let $\mathrm{p}(x) = 2x^2 - ax + 6 - a$, where $a > 0$. The equation $\mathrm{p}(x) = 0$ has equal roots.

(a) Find the value of a,

(b) Solve the equation $\mathrm{p}(x) = ax - a$. **(5 marks)**

33. [S.5 23-24 Mid-year,#18]

It is given that α and β are the roots of the equation $(2x - m)(x - 2) - 1 = 0$, where *m* is a constant.

(a) Express $\alpha + \beta$ in terms of *m*. **(2 marks)**

(b) The 1st, 2nd and 3rd term of a geometric sequence are $3^{2\alpha}, 9$ and $3^{2\beta}$ respectively. Find the value of *m*. **(3 marks)**

34. [S.6 23-24 Timed Practice 3,#9]

It is given that the length and the width of a rectangle are $(3k - 4)$ cm and $(2k - 3)$ cm respectively, where *k* is an integer. If the area of the rectangle is less than 15 cm^2. Find the maximum value of *k*.

(3 marks)

~End~