

ANSWER SHEET

Name: Key

Mathematics Teacher: _____

1. A B C **(D)**
2. A B C **(D)**
3. **(A)** B C D
4. A B **(C)** D
5. A **(B)** C D
6. A B **(C)** D
7. A B C **(D)**
8. A **(B)** C D
9. A B **(C)** D
10. A **(B)** C D
11. **(A)** B C D
12. A **(B)** C D
13. A **(B)** C D
14. A B **(C)** D

15. A **(B)** C D
16. A B **(C)** D
17. **(A)** B C D
18. A **(B)** C D
19. A B C **(D)**
20. **(A)** B C D
21. **(A)** B C D
22. A B **(C)** D
23. A B C **(D)**
24. A B **(C)** D
25. A B **(C)** D
26. A B C **(D)**
27. **(A)** B C D

28. $x=3$ $d=9$.

29. $t_n = 40000(0.85)^{n-1}$
 $S_{\infty} = 266,667$

30. $x = 12.2$
 $y = 21.7$

31. $y = -5(x-1)^2 + 7$
 $y = 5.75$

32. $x = \frac{3 \pm \sqrt{19}}{2}$

33. $n = 4$
 $m = -12$ (reject)

34. $x = \frac{3}{2}, x = 1$

$x \neq -2, 3$

35. Invariant points: $x = -\frac{3}{2}, -\frac{5}{2}$

VA: $x = -2$
y-int: $y = \frac{1}{4}$

36. $x = 0$

37. $x = 3, y = 5$

38. $x \geq 6$ or $x \leq -1$



Mathematics 2200
Common Mathematics Assessment
Sample 2013

Name: _____
Mathematics
Teacher: _____

27 Selected Response
11 Constructed Response

27 marks
40 marks

FINAL

67 Marks

TIME: 2 HOURS

NOTE

Diagrams are not necessarily drawn to scale.

FORMULAE

$$t_n = t_1 + (n - 1)d, n \in N$$

$$t_n = t_1 r^{n-1}, n \in N$$

$$S_n = \frac{n}{2}(t_1 + t_n)$$

$$S_n = \frac{t_1(r^n - 1)}{r - 1}$$

$$S = \frac{t_1}{1 - r}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

$$a^2 = b^2 + c^2 - 2bccosA$$

$$cosA = \frac{b^2 + c^2 - a^2}{2bc}$$

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Common Mathematics Assessment - Sample 2013

Selected Response:

Choose the appropriate response on the answer sheet or SCANTRON.

1. How many terms are in the sequence $\{3, 1, -1, \dots, -91\}$

(A)	43	$t_n = t_1 + (n-1)d$	$-91 = -2n + 5$
(B)	45	$= 3 + (n-1)(-2)$	$-96 = -2n$
(C)	46	$= 3 - 2n + 2$	$48 = n$
(D)	48	$t_n = -2n + 5$	

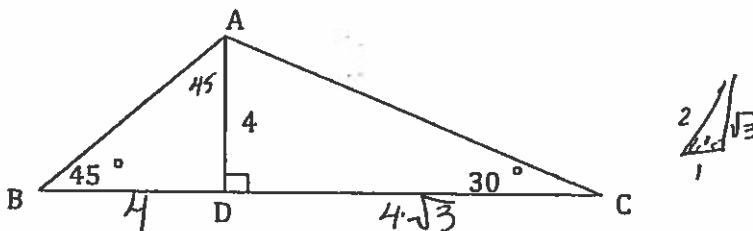
2. In an arithmetic sequence, $t_3 = m$ and $t_4 = n$. Which expression represents t_6 ?

(A)	$2m - n$	$d = t_4 - t_3 = n - m$
(B)	$2n - m$	$t_6 = t_4 + 2(n - m)$
(C)	$3n - m$	$= n + 2n - 2m$
(D)	$3n - 2m$	$= 3n - 2m$

3. Which describes the series $\{-19, -\frac{19}{2}, -\frac{19}{4}, -\frac{19}{8}, \dots\}$?

(A)	convergent with a sum of -38	$S_\infty = \frac{t_1}{1-r}$ $= \frac{-19}{1-(\frac{1}{2})}$
(B)	convergent with no sum	
(C)	divergent with a sum of -38	
(D)	divergent with no sum	

4. What is the exact length of BC?



- | | |
|-----|-------------------------|
| (A) | 6 |
| (B) | 12 |
| (C) | $4 + 4\sqrt{3}$ |
| (D) | $4\sqrt{2} + 4\sqrt{3}$ |

5. The point $(6, -8)$ lies on the terminal arm of an angle θ in standard position. What is the value of $\sin \theta$?

(A)	$-\frac{4}{3}$		
(B)	$-\frac{4}{5}$		$\sin \theta = \frac{-8}{10} = -\frac{4}{5}$
(C)	$\frac{3}{5}$		
(D)	$\frac{4}{5}$		

6. Solve: $\cos \theta = -0.6947$, where $0^\circ \leq \theta \leq 360^\circ$

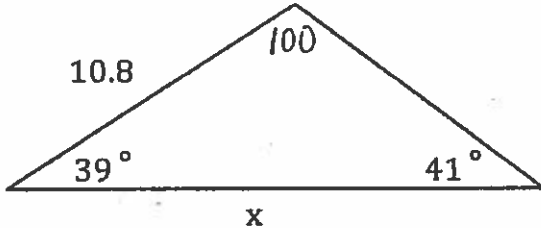
- (A) $\theta = 46^\circ$ and $\theta = 134^\circ$
- (B) $\theta = 46^\circ$ and $\theta = 314^\circ$
- (C) $\theta = 134^\circ$ and $\theta = 226^\circ$
- (D) $\theta = 226^\circ$ and $\theta = 314^\circ$

ref L = 46

x	s	A
*	T	C

 cos neg
 Q2/Q3
 180-46
 180+46

7. What is the length of x?



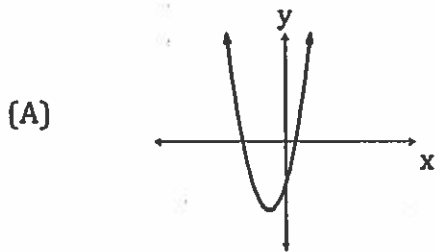
- (A) 7.2
- (B) 10.4
- (C) 11.3
- (D) 16.2

$$\frac{x}{\sin 100} = \frac{10.8}{\sin 41}$$

$$x \cdot \frac{\sin 41}{\sin 41} = \frac{\sin 100 \cdot 10.8}{\sin 41}$$

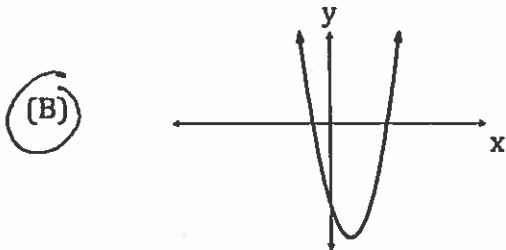
$$x = 16.2$$

8. Which represents the function $y = 2x^2 - 4x - 5$?

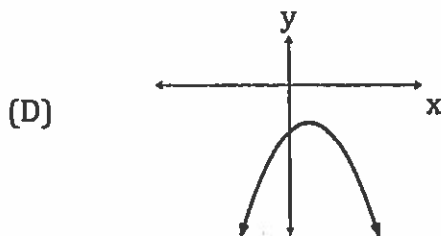
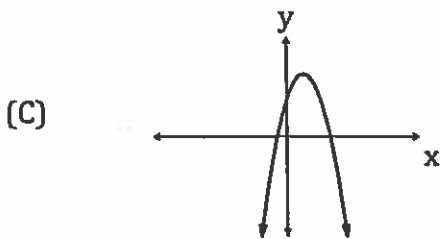


$$x = \frac{-b}{2a} = -\frac{(-4)}{2(2)}$$

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



opens up.



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Common Mathematics Assessment - Sample 2013

9. Which represents a parabola with y-intercept $(0, -15)$ and vertex $(1, -5)$?

- (A) $f(x) = -20(x - 1)^2 - 5$
 (B) $f(x) = -20(x + 1)^2 + 5$
 (C) $f(x) = -10(x - 1)^2 - 5$
 (D) $f(x) = -10(x + 1)^2 + 5$

$$y = a(x - 1)^2 - 5$$

$$-15 = a(0 - 1)^2 - 5$$

$$-10 = a(-1)^2$$

10. If $y = 2x^2 + 12x + 10$ is written in the form $y = a(x - p)^2 + q$, what is the value of q ?

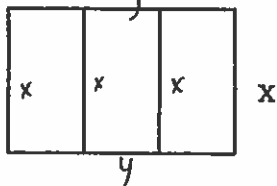
- (A) -26
 (B) -8
 (C) 1
 (D) 28

$$x = -\frac{b}{2a} = \frac{-12}{2(2)} = -3$$

$$y = 2(-3)^2 + 12(-3) + 10$$

$$= 2(9) - 36 + 10$$

11. A rancher plans to use 430 m of fencing to build a cattle enclosure with three equal sections. Which represents the total area of the enclosure in terms of its width, x ?



$$4x + 2y = 430$$

$$2y = 430 - 4x$$

$$y = 215 - 2x$$

- (A) $A = x(215 - 2x)$
 (B) $A = x(215 - x)$
 (C) $A = x(430 - 2x)$
 (D) $A = x(430 - x)$

12. Theresa's incorrect solution to the equation $4x^2 - 7x - 3 = 0$ is shown. In which step does the first error occur?

Step 1 $x = \frac{7 \pm \sqrt{(-7)^2 - (4)(4)(-3)}}{2(4)}$

Step 2 $x = \frac{7 \pm \sqrt{49 + 48}}{8}$

Step 3 $x = \frac{7 \pm \sqrt{1}}{8}$

Step 4 $x = 1, x = \frac{3}{4}$

- (A) 1
 (B) 2
 (C) 3
 (D) 4

13. Which describes the quadratic function that has vertex $(-9, 3)$ and passes through the point $(-4, -2)$?

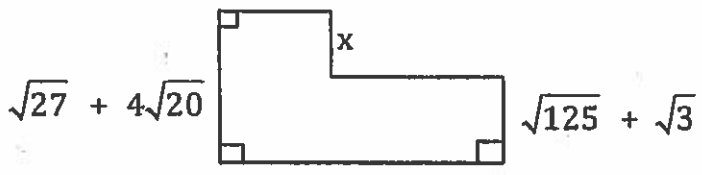
- (A) The axis of symmetry is $x = -9$ and the discriminant is negative.
 (B) The axis of symmetry is $x = -9$ and the discriminant is positive.
 (C) The axis of symmetry is $x = 9$ and the discriminant is negative.
 (D) The axis of symmetry is $x = 9$ and the discriminant is positive.



14. Solve: $2x(x - 3) + 5(x - 3) = 0$

- (A) $x = -3, x = -\frac{5}{2}$
- (B) $x = -3, x = \frac{5}{2}$
- (C) $x = 3, x = -\frac{5}{2}$
- (D) $x = 3, x = \frac{5}{2}$
- $(x-3)(2x+5)$
 $x=3 \quad x=-\frac{5}{2}$

15. Determine a simplified expression for the value of x :



- (A) $2\sqrt{3} + \sqrt{5}$
- (B) $2\sqrt{3} + 3\sqrt{5}$
- (C) $4\sqrt{3} + \sqrt{5}$
- (D) $4\sqrt{3} + 3\sqrt{5}$
- $(\sqrt{27} + 4\sqrt{20}) - (\sqrt{125} + \sqrt{3})$
 $3\sqrt{3} + 8\sqrt{5} - 5\sqrt{5} - \sqrt{3}$
 $2\sqrt{3} + 3\sqrt{5}$

16. Write $4x^3y^2\sqrt{5xy}$ as an entire radical.

- (A) $\sqrt{20x^7y^5}$
- (B) $\sqrt{20x^{10}y^5}$
- (C) $\sqrt{80x^7y^5}$
- (D) $\sqrt{80x^{10}y^5}$
- $\sqrt{16x^6y^4 \cdot 5xy}$

17. Simplify completely: $\frac{\sqrt{6}}{\sqrt{3}+\sqrt{2}} \times \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}-\sqrt{2}}$

- (A) $3\sqrt{2} - 2\sqrt{3}$
- (B) $3\sqrt{2} + 2\sqrt{3}$
- (C) $\frac{3\sqrt{2} - 2\sqrt{3}}{5}$
- (D) $\frac{3\sqrt{2} + 2\sqrt{3}}{5}$
- $\frac{\sqrt{18} - \sqrt{12}}{\sqrt{9} - \sqrt{4}}$
 $\frac{3\sqrt{2} - 2\sqrt{3}}{1}$

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18. Simplify completely: $\frac{\sqrt[3]{2}}{\sqrt[3]{6}} \times \frac{\sqrt[3]{36}}{\sqrt[3]{36}}$

(A) $\frac{\sqrt[3]{3}}{3}$

(B) $\frac{\sqrt[3]{9}}{3}$

(C) $\frac{\sqrt[3]{12}}{6}$

(D) $\frac{\sqrt[3]{72}}{6}$

$$\frac{\sqrt[3]{72}}{6}$$

19. Simplify completely: $\frac{1}{x} - \frac{2}{x+6}$

(A) $-\frac{1}{x}$

(B) $-\frac{1}{2x+6}$

(C) $\frac{-1}{x(x+6)}$

(D) $\frac{-x+6}{x(x+6)}$

$$\frac{1(x+6) - 2(x)}{x(x+6)}$$

$$x+6-2x$$

$$-x+6$$

20. Simplify completely: $\frac{9x - \frac{1}{x}}{6 + \frac{2}{x}}$

(A) $\frac{3x-1}{2}$

(B) $\frac{3x+1}{2}$

(C) $\frac{9x-1}{8}$

(D) $\frac{9x-1}{2(3x+1)}$

$$\frac{9x^2 - 1}{6x + 2} \div \frac{2}{x}$$

$$\frac{(3x-1)(3x+1)}{2(3x+1)} \times \frac{x}{2}$$

21. Simplify completely: $\frac{25-x^2}{x^2} \cdot \frac{x^2-2x}{x^2+3x-10}$

(A) $\frac{5-x}{x}$

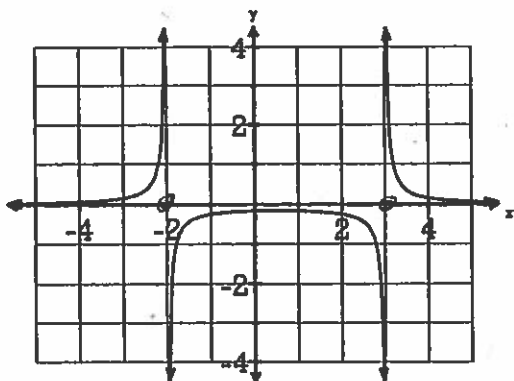
(B) $\frac{x+5}{x}$

(C) $\frac{(5-x)(x+2)}{x^2}$

(D) $\frac{(x+5)(x-2)}{x^2}$

$$\frac{(5-x)(5+x)}{x^2} \cdot \frac{x(x-2)}{(x+5)(x-2)}$$

22. The graph shown represents the reciprocal of which quadratic function?



$$(x+2)(x-3)$$

$$x^2 - x - 6$$

- (A) $f(x) = x^2 - 5x + 6$
 (B) $f(x) = x^2 + 5x + 6$
 (C) $f(x) = x^2 - x - 6$
 (D) $f(x) = x^2 + x - 6$

23. What is the range of $y = |x + 5|$?

- (A) $\{y | y > -5, y \in \mathbb{R}\}$
 (B) $\{y | y \geq -5, y \in \mathbb{R}\}$
 (C) $\{y | y > 0, y \in \mathbb{R}\}$
 (D) $\{y | y \geq 0, y \in \mathbb{R}\}$

24. Which is a solution to the system $\begin{cases} \frac{1}{2}x^2 + x - y = 13 \\ x^2 - 2x + y = 7 \end{cases}$?

- (A) $(-2, -1)$
 (B) $(2, -9)$
 (C) $(4, -1)$
 (D) $(6, -11)$

$$\frac{3}{2}x^2 - x = 20$$

$$3x^2 - 2x - 40 = 0$$

$$(3x + 10)(x - 4) = 0$$

$$x = 4$$

$$16 - 8 + y = 7$$

$$4x - 3y = 19$$

25. The first four steps of an incorrect solution to the system $\begin{cases} 4x^2 + 3x - 2y = 4 \\ x^2 - 2x - y = 1 \end{cases}$ are shown. Identify the step in which the first error occurs.

Step 1 : $\begin{cases} 4x^2 + 3x - 2y = 4 \\ -2x^2 + 4x + 2y = 1 \end{cases}$

Step 2: $2x^2 + 7x = 5$

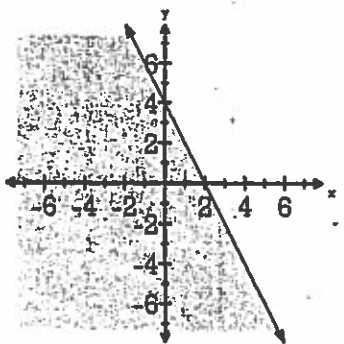
Step 3: $2x^2 + 7x + 5 = 0$

Step 4: $(2x + 5)(x + 1) = 0$

- (A) 1
 (B) 2
 (C) 3
 (D) 4

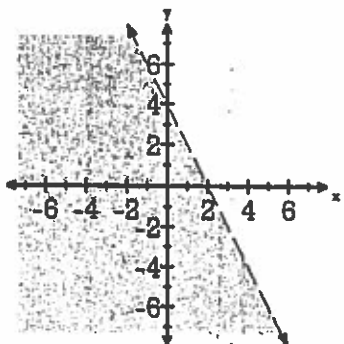
26. Which represents the inequality $2x + y > 4$?

(A)



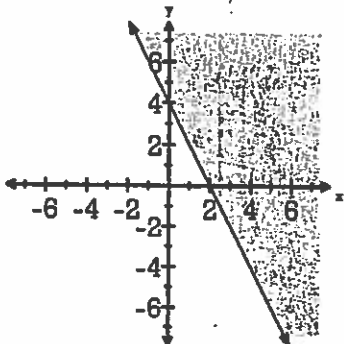
$$y = -2x + 4$$

(B)

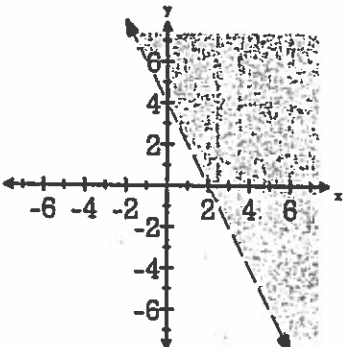


$$\begin{aligned} 2(-2) + 1 \\ -4 + 1 \\ -3 > 4 \end{aligned}$$

(C)



(D)



27. Which is a solution to $y > -2(x - 1)^2 + 3$?

- (A) (0, 2)
- (B) (1, 2)
- (C) (2, 0)
- (D) (2, 1)

$$\begin{aligned} 2 &> -2(0-1)^2 + 3 \\ 2 &> 1 \quad \checkmark \end{aligned}$$

Constructed Response:

Answers to be written on this paper in the space provided. Show all workings.

28. The first three terms of an arithmetic sequence are $\{x + 4, 5x + 1, 7x + 4, \dots\}$. Algebraically determine the value of x and state the common difference. 3 marks

$$\begin{aligned} (5x+1) - (x+4) &= (7x+4) - (5x+1) \\ 5x+1-x-4 &= 7x+4-5x-1 \\ 4x-3 &= 2x+3 \\ 4x-2x &= 3+3 \\ 2x &= 6 \\ x &= 3 \\ d &= (5x+1) - (x+4) \\ &= (5(3)+1) - (3+4) \\ &= 16 - 7 = 9 \end{aligned}$$

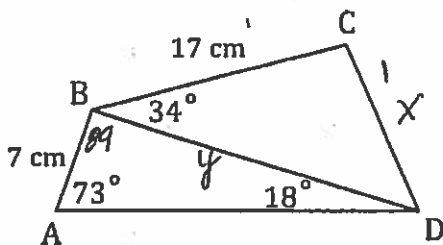
29. The monthly production of crude oil, in barrels, for the first four months for a test well at Hebron is given below. In theory, what is the expected lifetime production of the well, to the nearest barrel? 3 marks

Month	# of Barrels
1	40 000
2	34 000
3	28 900
4	24 565

> 0.85
 > 0.85
 > 0.85

$$\begin{aligned} t_n &= 40000(0.85)^{n-1} \\ S_{\infty} &= \frac{t_1}{1-r} = \frac{40000}{1-(0.85)} = \frac{40000}{0.15} = 266,667 \end{aligned}$$

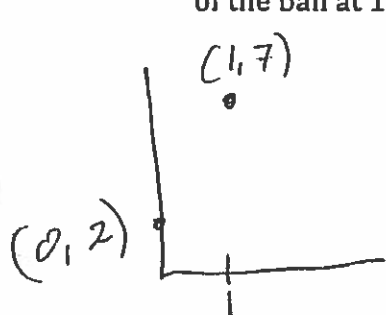
30. Calculate the length of CD to the nearest tenth of a cm. 4 marks



$$\begin{aligned} \frac{y}{\sin 73^\circ} &= \frac{7}{\sin 18^\circ} \\ y &= \frac{7}{\sin 18^\circ} \times \sin 73^\circ \\ y &= 21.7 \end{aligned}$$

$$\begin{aligned} x^2 &= (21.7)^2 + (17)^2 - 2(21.7)(17)\cos 34^\circ \\ x^2 &= 148.226079 \\ x &= 12.2 \end{aligned}$$

31. From a height of 2 m, a volleyball is hit into the air. After 1 second, the ball reaches a maximum height of 7 m. Write the quadratic function, in the form $y = a(x - p)^2 + q$, that models the situation and use it to determine the height of the ball at 1.5 seconds. 3 marks



$$y = a(x - 1)^2 + 7$$

$$2 = a(0 - 1)^2 + 7$$

$$2 = a(1) + 7$$

$$-5 = a(1)$$

$$y = -5(x - 1)^2 + 7$$

$$y = -5(1.5 - 1)^2 + 7$$

$$y = -5(0.5)^2 + 7$$

$$y = -5(0.25) + 7$$

$$y = -1.25 + 7$$

$$y = 5.75$$

Function _____

Height _____

32. Algebraically determine the exact roots, in simplest form: 4 marks

$$16(x^2 - 1) = 24(2x + 1)$$

$$16x^2 - 16 = 48x + 24$$

$$16x^2 - 48x - 40 = 0$$

$$2x^2 - 6x - 5 = 0$$

$$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(2)(-5)}}{2(2)}$$

$$\therefore = \frac{6 \pm \sqrt{36 + 40}}{4} = \frac{6 \pm \sqrt{76}}{4} = \frac{6 \pm 2\sqrt{19}}{4} = \frac{3 \pm \sqrt{19}}{2}$$

33. State restrictions on the variable and solve: $\frac{1}{2}m - \sqrt{13 - m} = -1$ 4 marks

$$\left(\frac{1}{2}m + 1\right)^2 = (\sqrt{13 - m})^2$$

$$\left(\frac{1}{2}m + 1\right)\left(\frac{1}{2}m + 1\right) = 13 - m$$

$$\frac{1}{4}m^2 + \frac{1}{2}m + \frac{1}{2}m + 1 = 13 - m$$

$$\frac{1}{4}m^2 + m + 1 - 13 + m = 0$$

$$4 \times \left(\frac{1}{4}m^2 + 2m - 12\right) = 0$$

$$m^2 + 8m - 48 = 0$$

$$(m + 12)(m - 4) = 0$$

$$m \neq -12 \quad m = 4$$

reject

check;

$$\frac{1}{2}(-12) - \sqrt{13 - (-12)} = -1$$

$$-6 - \sqrt{25} = -1$$

$$-6 - 5 = -1$$

$$-11 = -5$$

$$\frac{1}{2}(4) - \sqrt{13 - 4} = -1$$

$$2 - \sqrt{9} = -1$$

$$2 - 3 = -1$$

$$-1 = -1 \quad \checkmark$$

34. Identify all non-permissible values and solve: $\frac{3(3x-1)}{x^2-x-6} - \frac{6}{x-3} = 2$ 4 marks

$$\frac{9x-3}{(x+2)(x-3)} \times (x+2)(x-3) - \frac{6}{x-3} \cdot (x+2)(x-3) = 2(x+2)(x-3)$$

$$9x-3 - 6(x+2) = 2(x^2-x-6)$$

$$9x-3 - 6x-12 = 2x^2-2x-12$$

$$3x-15 = 2x^2-2x-12$$

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

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

$$x = \frac{3}{2} \quad x = 1$$

$$x \neq -2, 3$$

35. Algebraically determine the invariant points, equations of asymptotes, and x- and y-intercepts for the functions $f(x) = 2x + 4$ and $y = \frac{1}{f(x)}$. 4 marks

Sketch both graphs on the same set of axes.

$$2x+4=1$$

$$2x=-3$$

$$x = -\frac{3}{2}$$

$$2x+4=-1$$

$$2x=-5$$

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

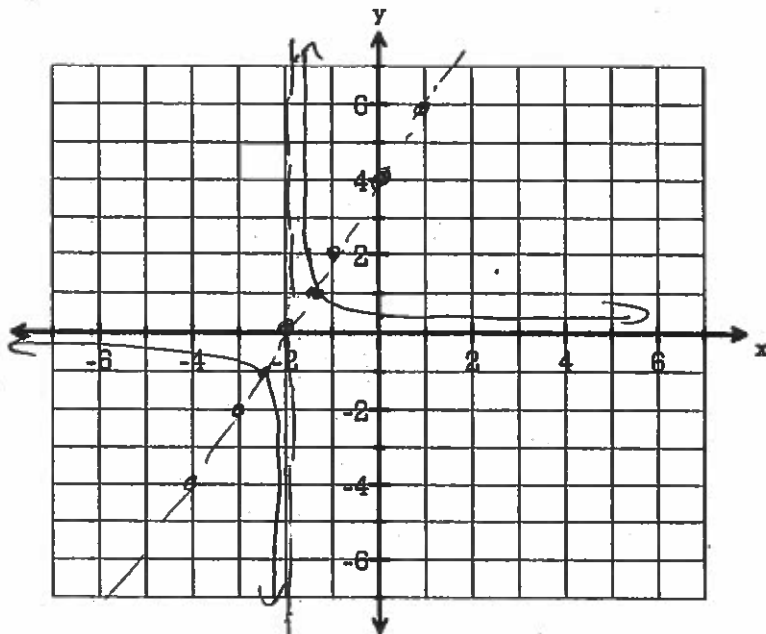
$$2x+4=0$$

$$2x=-4$$

$$x = -2 \leftarrow \text{VA}$$

y-int:

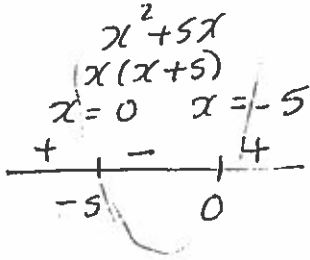
$$y = \frac{1}{2(0)+4} = \frac{1}{4}$$



36. Solve algebraically:

$$|x^2 + 5x| = 2x$$

4 marks



Case 1: $x \leq -5, x \geq 0$

$$x^2 + 5x = 2x$$

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

$$x(x+3) = 0$$

$$x = 0 \quad x = -3$$

reject

Case 2: $-5 < x < 0$

$$-(x^2 + 5x) = 2x$$

$$-x^2 - 5x = 2x$$

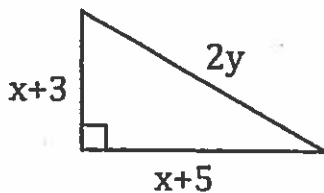
$$0 = x^2 + 7x$$

$$x(x+7) = 0$$

$$x = 0 \quad x = -7$$

37. The right triangle shown has a perimeter of 24 cm and an area of $(2y + 14) \text{ cm}^2$. Algebraically determine the value(s) of x and y .

4 marks



$$2x + 8 + 2y = 24$$

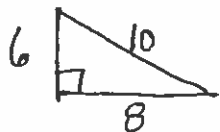
$$2x + 2y = 16$$

$$\frac{1}{2}(x+3)(x+5) = 2y + 14$$

$$\frac{1}{2}(x^2 + 8x + 15) = 2y + 14$$

$$x^2 + 8x + 15 = 4y + 28$$

$$x^2 + 8x - 4y = 13$$



$$x^2 + 8x - 4(8-x) = 13$$

$$x^2 + 8x - 32 + 4x - 13 = 0$$

$$x^2 + 12x - 45 = 0$$

$$(x+15)(x-3) = 0$$

$$x = -15 \quad x = 3$$

reject
can't be
neg.

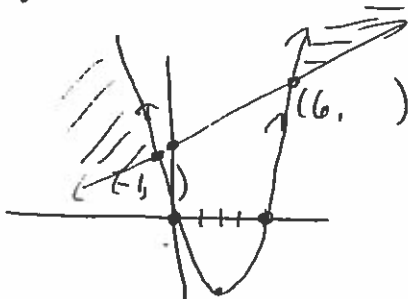
$$y = 8 - 3$$

$$y = 5$$

$$(3, 5)$$

38. Algebraically determine the value(s) of x where $y = x^2 - 4x$ lies above $y = x + 6$.

3 marks



$$x(x-4)$$

$$x = 0 \quad x = 4$$

$$x = \frac{b}{2a} = \frac{4}{2} = 2$$

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

$$x^2 - 5x - 6 = 0$$

$$(x-6)(x+1) = 0$$

$$x = 6 \quad x = -1$$

$$x \geq 6, x \leq -1$$

