

# PRE-CALCULUS 30S PRACTICE EXAM

Name: Key

## Part A. Multiple Choice (20 marks)

B 1. Determine  $t_{11}$  of this arithmetic sequence:  $-20, -35, -50, -65, \dots$

A.  $t_{11} = -80$

C.  $t_{11} = -15$

B.  $t_{11} = -170$

D.  $t_{11} = -20$

A 2. 4096 is a term in which geometric sequence?

A. 2, 4, 8, 16, ...

C. 2, 12, 72, 432, ...

B. 4, 24, 144, 864, ...

D. 3, 6, 12, 24, ...

A 3. Evaluate:  $|-11 + (-1)| - 7|7 - (21)|$

A. -86

B. -208

C. 266

D. -206

D 4. Write this entire radical as a mixed radical:  $\sqrt{150}$

A.  $10\sqrt{6}$

B.  $10\sqrt{12}$

C.  $5\sqrt{36}$

D.  $5\sqrt{6}$

C 5. Expand and simplify this expression:  $-\sqrt{2}(\sqrt{7} - 5)$

A.  $-7\sqrt{2} + \sqrt{10}$

C.  $-\sqrt{14} + 5\sqrt{2}$

B.  $-2\sqrt{7} + 5\sqrt{2}$

D.  $\sqrt{14} - \sqrt{10}$

A 6. A quadratic equation has the roots of -1 and 4. Find the equation.

A.  $x^2 - 3x - 4 = 0$

C.  $x^2 - 4x - 1 = 0$

B.  $x^2 - 3x + 4 = 0$

D.  $x^2 + 3x - 4 = 0$

47

C 7. The discriminant of  $y = 3x^2 + 2x - 4$  would indicate that:

- A. There are no roots.
- B. There is 1 root.
- C. There are 2 roots.
- D. There is not enough information.

A 8. Solve:  $\frac{w-5}{w^2} = \frac{1}{20}$

$w-5 = \frac{w^2}{20}$

$20w - 100 = w^2$

$w^2 - 20w + 100 = 0$   
 $(w-10)(w-10)$

- A.  $w = 10$
- B.  $w = -5$
- C.  $w = 10$  or  $w = -10$
- D. No solution.

C 9. If the graph of the function whose equation is  $y = -2(x-4)^2 + 2$  is shifted 4 units up, and 7 units left, the equation of the new function is:

- A.  $y = -2(x-11)^2 + 6$
- B.  $y = -2(x-11)^2 - 2$
- C.  $y = -2(x+3)^2 + 6$
- D.  $y = -2(x+3)^2 - 2$

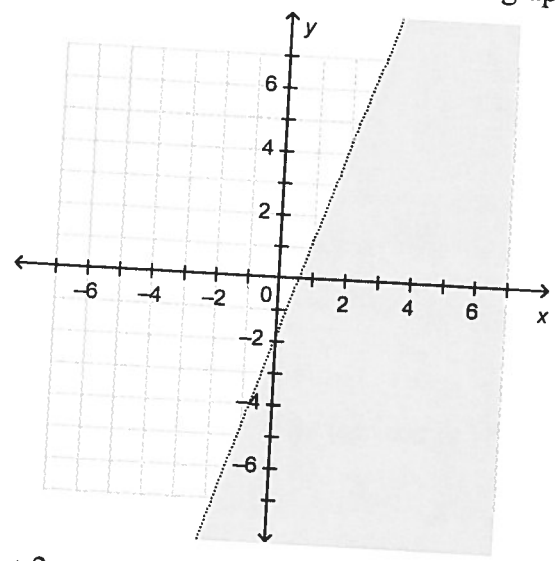
B 10. For the function  $y = -(x+3)^2 + 7$ , which of the following is **not** true?

- A. The vertex is  $(-3, 7)$ .
- B. The y-intercept is 7.
- C. The graph opens down.
- D. The point  $(2, -18)$  is on the graph.

D 11. Which of the following points satisfies the conditions  $x < -3$  and  $y > 2x - 1$ ?

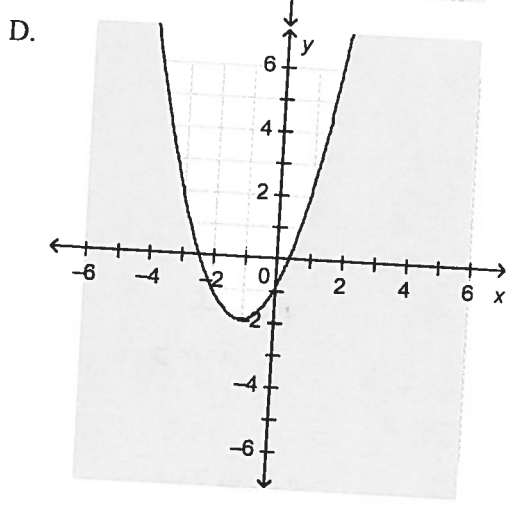
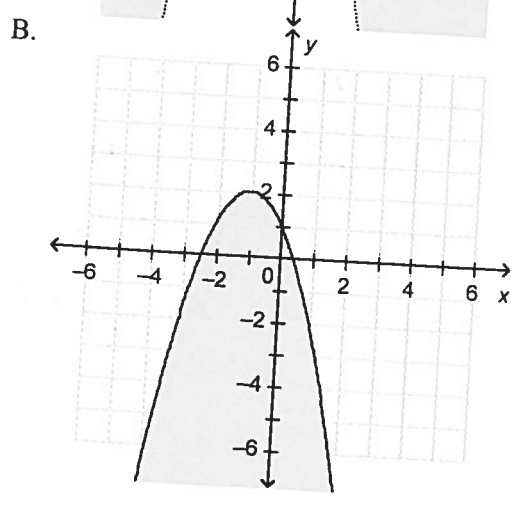
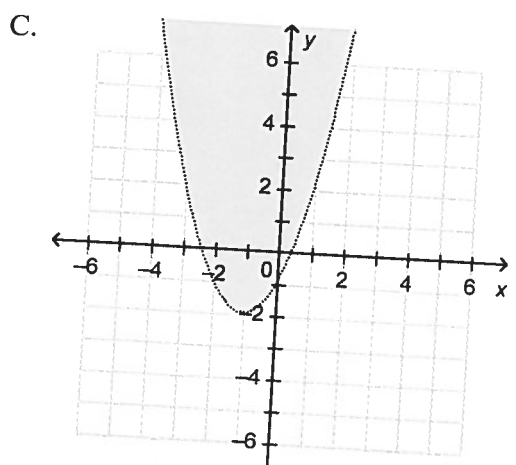
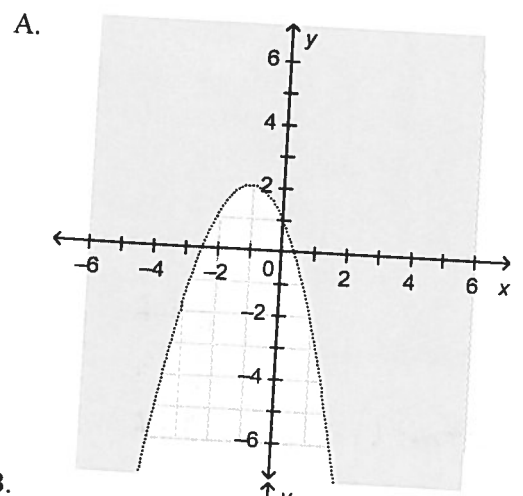
- A.  $(0, -3)$
- B.  $(0, 0)$
- C.  $(-3, -7)$
- D.  $(-5, -10)$

12. Which inequality best describes this graph?



- A.  $y > 3x + 2$       B.  $y \geq 3x - 2$       C.  $y \leq 3x + 2$       D.  $y < 3x - 2$

13. Which graph represents the inequality  $y \leq x^2 + 2x - 1$ ?



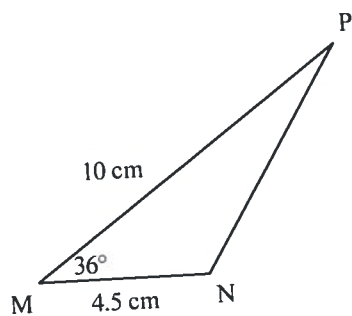
A 14. The point  $P(4, -3)$  lies on the terminal arm of an angle  $\theta$  in standard position. Determine the measure of  $\theta$  to the nearest degree.

- A.  $323^\circ$       B.  $-143^\circ$       C.  $233^\circ$       D.  $127^\circ$

B 15. In which quadrant is  $\sin \theta$  positive and  $\cos \theta$  negative?

- A. 1      B. 2      C. 3      D. 4

D 16. In  $\triangle PMN$ , determine the length of  $PN$  to the nearest tenth of a centimetre.



- A. 9.2 cm      B. 47.4 cm      C. 13.9 cm      D. 6.9 cm

B 17. Determine the non-permissible values for this rational expression:

$$\frac{-9x+3}{6x^2+10x-4}$$

$$2(3x^2+5x-2)$$

$$p = -6$$

$$q = 4$$

$$r = 6, -1$$

A.  $x \neq \frac{-1}{3}$  and  $x \neq 2$

C.  $x \neq -2$

B.  $x \neq \frac{1}{3}$  and  $x \neq -2$

D.  $x \neq 2$

$$3x^2 + 6x - x - 2$$

$$3x(x+2) - 1(x+2)$$

$$(3x-1)(x+2)$$

$$x \neq \frac{1}{3} \quad x \neq -2$$

A 18. Solve this equation:  $|2x+16|=10$

- A.  $x = -3$  and  $x = -13$   
 B.  $x = -3$  and  $x = 10$

- C.  $x = 10$  and  $x = -10$   
 D.  $x = -13$  and  $x = -10$

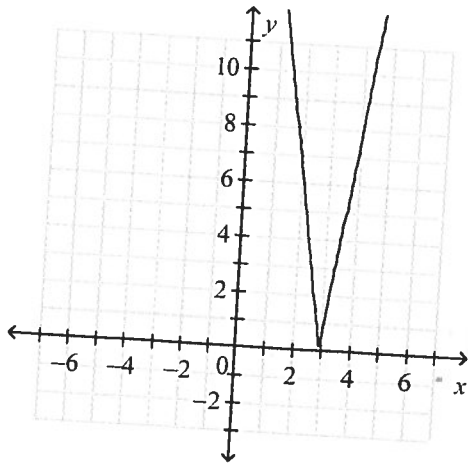
$$2x = -6$$

$$x = -3$$

$$-2x = 26$$

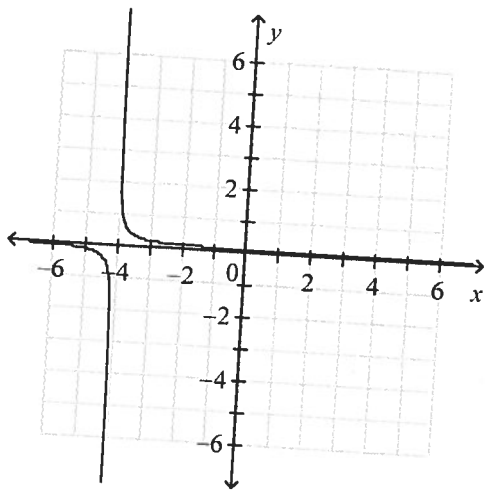
$$x = -13$$

19. Which absolute value function is represented by this graph?



- A.  $y = |7x - 21|$   
B.  $y = |7x^2 - 21|$   
C.  $y = |-7x - 21|$   
D.  $y = |7x^2 - 21x|$

20. What is the equation of the vertical asymptote of this graph of a reciprocal function?



- A.  $x = 0$   
B.  $x = -4$   
C.  $y = 0$   
D.  $y = -4$

**Part B. Long Answer (80 marks)**

Instructions: You may use your calculator.  
Show all work.

13. Consider each arithmetic series and determine the indicated value.

(2 marks)

a)  $3 + 8 + 13 + \dots$  Determine the sum of the first 20 terms.

$$S_n = \frac{20(2(3) + 5(19))}{2} = 1010$$

b)  $-4 - 7 - 10 - \dots$  Determine the term number for  $-52$ .

(2 marks)

$$-52 = -4 + (n-1)(-3)$$

$$-48$$

$$-3 = n-1$$

$$16 = n-1$$

$$17 = n$$

14. A geometric sequence has these terms:  $t_4 = 8, t_5 = 2, t_6 = \frac{1}{2}$

(1 mark)

a) State the common ratio, and find the first term.

$$r = 0.75$$

$$t_1 = 512$$

b) Find the sum if the sequence is infinite.

(1 mark)

$$S_{\infty} = \frac{512}{1-0.75} = 682.7$$

15. Joel worked at Series Inc. for the summer. He earned \$56 on the first day. His pay was increased at a rate of 2.1% with each subsequent day. Determine the total amount or sum Joel earned after 16 days. The first three terms are given. (3 marks)

\$56, \$57.18, \$58.38, ...

$$S_{16} = \frac{56(1 - 0.021^{16})}{1 - 0.021} = \$1051.94$$

16. Solve and verify the solution. (2 marks)

$$\sqrt{2x+1} = 5$$

$$2x+1 = 25$$

$$2x = 24$$

$$x = 12$$

17. Simplify each of the following.

a)  $\sqrt{12} + \sqrt[3]{32} - \sqrt{75} + \sqrt[3]{108}$

(3 marks)

$$2\sqrt{3} + 2\sqrt[3]{4} - 5\sqrt{3} + 3\sqrt[3]{4}$$

$$-3\sqrt{3} + 5\sqrt[3]{4}$$

b) Rationalize.  $\frac{2\sqrt{3}+9}{\sqrt{2}-8} \cdot \frac{\sqrt{2}+8}{\sqrt{2}+8} = \frac{2\sqrt{6}+9\sqrt{2}+16\sqrt{3}+72}{2-64}$

(3 marks)

c)  $(5\sqrt{2} + 3\sqrt{3})(\sqrt{2} - \sqrt{3})$

(3 marks)

$$10 - 5\sqrt{6} + 3\sqrt{6} - 9 = 1 - 2\sqrt{6}$$

18. Find the roots of the following quadratic equation by using the quadratic formula. Give exact values and simplify your answer fully.

$$3x^2 + 2x - 7 = 0$$

$$a = 3$$

$$b = 2$$

$$c = -7$$

(2 marks)

$$x = \frac{-2 \pm \sqrt{4 + 84}}{6}$$

$$x = \frac{-2 + \sqrt{88}}{6} = \frac{-2 + 2\sqrt{22}}{6}$$

$$x = \frac{-2 - \sqrt{88}}{6} = \frac{-2 - 2\sqrt{22}}{6}$$

7. Find the roots of the following quadratic equations by factoring.

a)  $6x^2 + 13x = 5$

(2 marks)

$$6x^2 + 13x - 5 = 0$$

$$\begin{matrix} -30 \\ 13 \\ 10 \end{matrix} \rightarrow (15, -2)$$

$$6x^2 + 15x - 2x - 5 = 0$$

$$3x(2x + 5) - 1(2x + 5)$$

$$(3x - 1)(2x + 5)$$

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



b)  $x^2 + 5 = 41$

(2 marks)

$$x^2 = 36$$

$$x = \pm 6$$

c)  $9x^2 + 66x + 21$

(2 marks)

$$3(3x^2 + 22x + 7)$$

$$3(3x^2 + x + 21x + 7)$$

$$3(x(3x+1) + 7(3x+1))$$

$$\rightarrow 3(x+7)(3x+1)$$

$$x = -7 \quad x = -\frac{1}{3}$$

d)  $36x^2 - 9 = 0$

(2 marks)

$$(6x+3)(6x-3)$$

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

3.3 8. Complete the square for the following quadratic.  
Write your answer in the form  $y = a(x - p)^2 + q$

(2 marks)

$$y = -3x^2 - 6x - 7$$

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

$$-3x^2 - 6x = 7$$

$$-3(x^2 + 2x) = 7$$

$$-3(x^2 + 2x + 1) = 7 - 3$$

$$-3(x+1)^2 = -5$$

$$y = -3(x+1)^2 + 5$$

9. A calculator company charges \$150 per calculator if 25 or fewer are ordered. For each additional calculator, the price is reduced by \$2.00.

a) Set up a quadratic formula to model this problem.

(2 marks)

$$\text{cost} = 150 - 2x$$

$$\# \text{ units} = 75 + x$$

$$(150 - 2x)(75 + x) = -2x^2 + 100x + 3750 = 0$$

$$-2x^2 + 100x = -3750$$

$$-2(x^2 - 50x) = -3750$$

b) How many should be ordered to make a maximum profit?

(1 mark)

$$-2(x^2 - 50x + 625) = -3750 - 1750$$

$$-2(x - 25)^2 = -5000$$

$$-2(x - 25)^2 + 5000$$

$$x = 25$$

$\therefore 50$  calculators

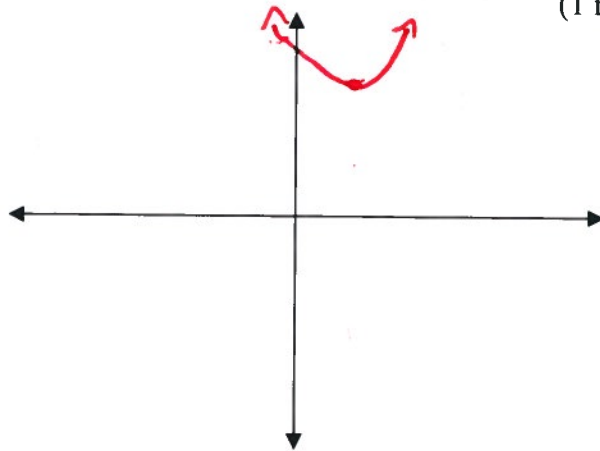
c) What is the maximum profit?

(1 mark)

$$\$5000$$

10. Consider:  $y = \frac{1}{2}(x-2)^2 + 4$

a) Sketch and label the curve. (1 mark)



b) Find each of the following. (4 marks)

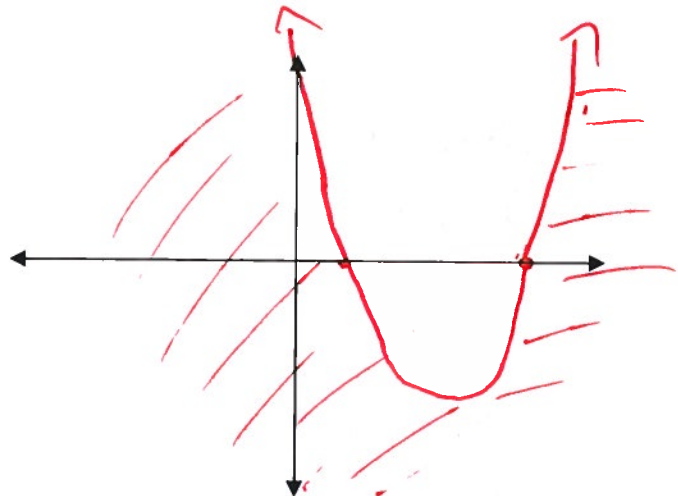
- i) the coordinates of the vertex
- ii) the domain
- iii) the range
- iv) the max or min
- iv) the equation of the axis of symmetry
- v) the x-intercepts
- vi) the y-intercept
- vii) the direction of opening

$2, 4$   
 $(-\infty, \infty)$   
 $[4, \infty)$   
 min  
 $x = 2$   
 $6$   
 None  
 up

11. Graph and shade the quadratic inequality. State the vertex and x-intercepts. (3 marks)

$y \leq x^2 - 8x + 12$

$(x-6)(x-2)$   
 $x=6 \quad x=2$



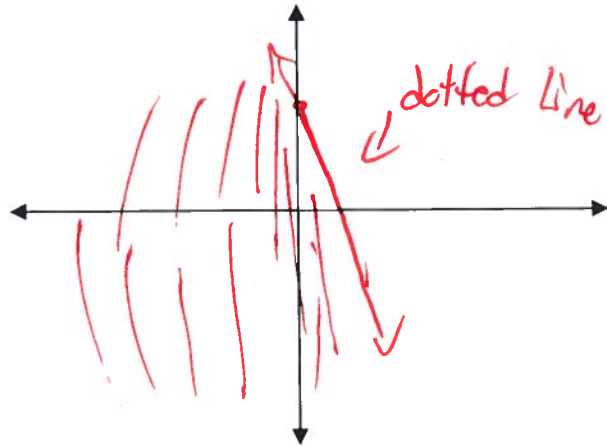
12. Graph and shade the linear inequality. Label intercepts. (3 marks)

(3 marks)

$$5x + 2y - 8 < 0$$

$$2y < -5x + 8$$

$$y < -\frac{5}{2}x + 4$$



13. Solve using a number line and sign diagram. State your answer in **interval notation**. (2 marks)

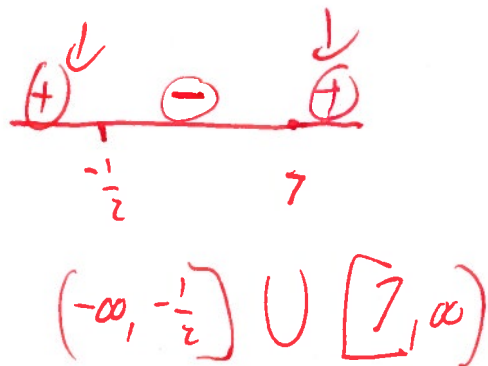
$$2x^2 - 13x - 7 \geq 0$$

$$2x^2 - 14x + 1x - 7$$

$$2x(x-7) + 1(x-7)$$

$$(2x+1)(x-7)$$

$$x = -\frac{1}{2} \quad x = 7$$



14. Solve the following system of equations using a method of your choice. (graphically- must sketch and label graph or algebraically- show all work) (3 marks)

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

$$x^2 - 2y = 3$$

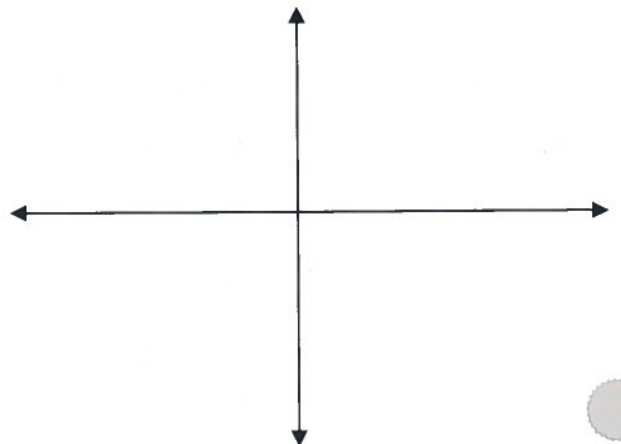
$$+ \quad (4x + 2y = 2)$$

$$x^2 + 4x = 5$$

$$x^2 + 4x - 5 = 0$$

$$(x+5)(x-1)$$

$$x = -5 \quad x = 1$$



15. ~~Draw in the terminal arms, state the reference angle and find  $\theta$  for each of the following without using a calculator.~~

a)  $\sin \theta = \frac{1}{2}$

$\theta = 30^\circ, 150^\circ$

(2 marks)

b)  $\cos \theta = \frac{-\sqrt{2}}{2}$

~~$\theta = 135^\circ, 225^\circ$~~   $= \frac{-1}{\sqrt{2}}$

~~$\theta = 150^\circ, 210^\circ$~~

$\theta = 135^\circ, 225^\circ$

(2 marks)

16. Find the exact value (non-calculator value) for each of the following.

a)  $\sin 45^\circ =$   ~~$\frac{\sqrt{2}}{2}$~~   $\frac{\sqrt{2}}{2}$

(.5 marks)

b)  $\cos 90^\circ =$   $0$

(.5 marks)

c)  $\tan 135^\circ =$   $-1$

(.5 marks)

d)  $\sin 120^\circ =$   $\frac{\sqrt{3}}{2}$

(.5 marks)

17. ~~Draw in the terminal arms, state the reference angle and find  $\theta$  for each of the following using a calculator.~~

a)  $\cos \theta = \frac{-2}{3}$

$131.8^\circ$

(2 marks)

b)  $\sin \theta = \frac{1}{4}$

$14.5^\circ$

(2 marks)

two sols

18. Given  $\triangle ABC$  with  $\angle A = 32^\circ$ ,  $a = 10$  and  $b = 15$ . Find all possible values. Round all answers to one decimal place. (4 marks)

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

$$B = 52.6^\circ$$

$$C = 95.4^\circ$$

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

$$c = 18.8$$

2

$$B = 180 - 52.6 - 127.4^\circ$$

$$C = 20.6^\circ$$

$$c = 6.6$$

19. Solve and state the non-permissible values.

(3 marks)

$$\frac{4}{x^2 - 7x + 12} = \frac{6}{x^2 - 6x + 9}$$

$$(x-3)(x-4) \quad (x-3)(x-3)$$

$$x \neq 3, 4$$

$$4(x-3) = 6(x-4)$$

$$4x - 12 = 6x - 24$$

$$12 = 2x$$

$$x = 6$$

20. Simplify this expression and state the non-permissible values.

(3 marks)

$$\frac{-20x^2 + 15x}{x^2 - 2x - 15} \div \frac{12x^2 - 17x + 6}{x - 5}$$

12  
-17  
-8, -9

$$\begin{aligned} & \rightarrow 12x^2 - 84x + 6 \\ & 4x(3x - 2) - 3(3x - 2) \end{aligned}$$

$$\frac{-5x(x-3)}{(x-5)(x+3)} \times \frac{(x-5)}{(4x-3)(3x-2)} = \frac{-5x(x-3)}{(x+3)(4x-3)(3x-2)}$$

$$x \neq 5, -3, \frac{3}{4}, \frac{2}{3}$$

21. Solve:  $x + 3 = |2x + 1|$  Verify your solution.

(3 marks)

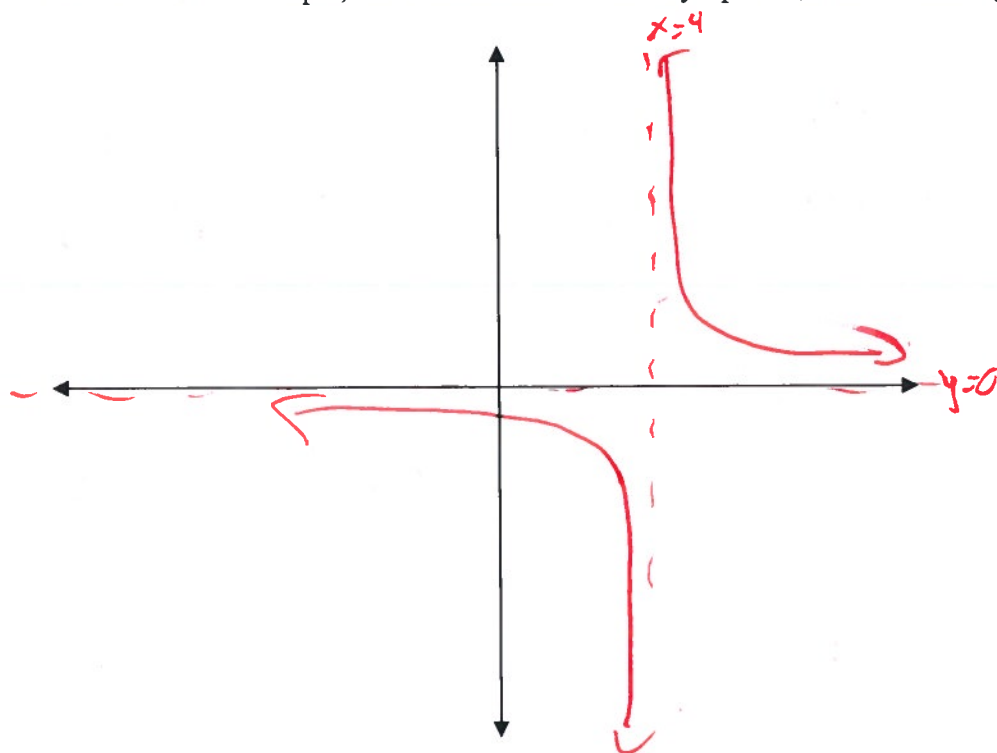
$$\begin{aligned} x + 3 &= 2x + 1 \\ 2 &= x \quad \checkmark \end{aligned}$$

$$\begin{aligned} x + 3 &= -2x - 1 \\ 3x &= -4 \\ x &= -\frac{4}{3} \quad \times \end{aligned}$$

22. Sketch the graph of  $y = \frac{1}{x-4}$ .

$x \neq 4$

State and label all intercepts, horizontal and vertical asymptotes, if there are any. (3 marks)



$y\text{-int} = -\frac{1}{4}$

23. Sketch the graph of  $y = |x+5|$ . Label all intercepts.

(2 marks)

