

Student Name: _____

First Name

Last Name

PART A

Calculators are allowed.

Score:

/50

Fill-in-the-blanks Section (1 mark each)

- 1) The sequence **18, 12, 6, ...** is an example of a(n) arithmetic sequence with the common difference of -6.
(difference/ratio) (arithmetic/geometric)
- 2) If the general term of a sequence is $t_n = 5(-3)^{n-1}$, the sequence has the first term of 5, and the common ratio of -3.
- 3) Completely simplified form of the radical $\sqrt{44}$ is $2\sqrt{11}$
- 4) The first step in rationalizing the denominator of the expression $\frac{5\sqrt{3}}{1+\sqrt{2}}$ should be to multiply the numerator and the denominator by $1-\sqrt{2}$
- 5) The simplified form of $5\sqrt{x} - 3 + \sqrt{x} + 1$ is $6\sqrt{x} - 2$
- 6) Another angle smaller than 360° that has the same cosine ratio as the angle 187° is 173°
- 7) In a non-right triangle where all 3 sides are known, we can use the cosine Law to solve for any one of the angles.
- 8) The sine is negative and the tangent is positive in the III quadrant.

S	A
T	C
- 9) The greatest common factor in the expression $2x^2y + 4x^2y^3$ is $2x^2y$
- 10) Factored form of $16x^2 - 9$ is $(4x-3)(4x+3)$
- 11) The roots of the equation $x(x-1)(x+4)$ are $0, 1, -4$
- 12) The restrictions on the variable in the equation $6 - \sqrt{x-5} = 2$ are $x \geq 5$
- 13) The parabola with the equation $y = -(x-5)^2 + 8$ opens down, and has the vertex at $(5, 8)$
(up/down)
- 14) Which value(s) of the discriminant mean that the quadratic equation has no real roots? $discr < 0$
- 15) The quadratic function $f(x) = 4(x+1)^2$ has a min of 0 at $(-1, 0)$.
(max/min)

/15

Short Response Questions (2 marks each)

Show work!! Put answers in the boxes provided.

16) A scientist starts an experiment with 6 bacteria in the first culture. The second culture contains 3 times more bacteria than the first. The third culture has 3 times more than the second, and so on.

a) How many bacteria are there in the 7th culture?

$$\begin{aligned} a &= 6 \\ r &= 3 \\ n &= 7 \end{aligned}$$

$$\begin{aligned} t_7 &= a(r)^{n-1} \\ &= 6(3)^{7-1} \\ &= 6(3)^6 \end{aligned}$$

Answer:

4374

/2

b) The scientist starts the experiment with 11 cultures. How many bacteria are there at the start of the experiment?

$$\begin{aligned} t_{11} &= ar^{n-1} \\ &= 6(3)^{11-1} \\ &= 6(3)^{10} \end{aligned}$$

Answer:

354294

/2

17) Simplify completely:

$$2\sqrt{8}(5\sqrt{2} - 3\sqrt{5})$$

$$10\sqrt{16} - 6\sqrt{50}$$

$$10(4) - 6 \cdot 5\sqrt{2}$$

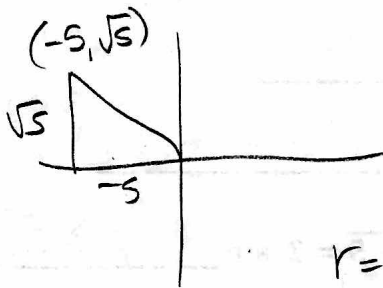
$$40 - 30\sqrt{2}$$

Answer:

40 - 30\sqrt{2}

/2

18) If the point $(-5, \sqrt{5})$ lies on the terminal arm of angle θ in standard position, what is the exact value of $\cos \theta$ in simplified (and rationalized) radical form?



$$\cos = \frac{x}{r} \quad \therefore \cos \theta = \frac{-5}{\sqrt{30}}$$

$$r = \sqrt{(-5)^2 + (\sqrt{5})^2}$$

$$r = \sqrt{25 + 5}$$

$$r = \sqrt{30}$$

$\cos \theta = \frac{-5}{\sqrt{30}}$ or $\frac{-5\sqrt{30}}{6}$

rationalize

$$\frac{-5}{\sqrt{30}} \cdot \frac{\sqrt{30}}{\sqrt{30}} = \frac{-5\sqrt{30}}{30} = \frac{-5\sqrt{30}}{6}$$

/8

$$9 \cdot 7 = 63$$

19) Solve the equation: $(x+1)(x-3) = 60$

$$x^2 - 3x + x - 3 = 60$$

$$x^2 - 2x - 63 = 0$$

$$(x-9)(x+7) = 0$$

$$x = 9 \text{ or } x = -7$$

Zero product law

Answer:

$$x = 9, -7$$

/2

20) Use the quadratic formula to solve the equation: $x^2 + 5x + 3 = 0$ (answer in simplified radical form)

$$a = 1$$

$$b = 5$$

$$c = 3$$

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

$$x = \frac{-5 \pm \sqrt{13}}{2}$$

$$= \frac{-5 \pm \sqrt{25 - 4(1)(3)}}{2(1)}$$

$$= \frac{-5 \pm \sqrt{25 - 12}}{2}$$

Answer:

$$x = \frac{-5 \pm \sqrt{13}}{2}$$

/2

21) What is the y-intercept of the parabola $y = -2(x+3)^2 - 6$?

\downarrow
 $x=0$

$$y = -2(0+3)^2 - 6$$

$$y = -2(9) - 6$$

$$y = -18 - 6$$

$$y = -24$$

Answer:

$$y = -24$$

/2

/6

Full Response Questions (marks are awarded for the clarity and accuracy of each step within solutions)

22) Determine the sum of the series: $-3.2 - 3 - 2.8 - \dots + 16.4$

arithmetic

$$a = -3.2$$

$$d = 0.2$$

$$t_n = 16.4$$

$$n = ?$$

$$16.4 = -3.2 + (n-1)(0.2)$$

$$16.4 = -3.2 + 0.2n - 0.2$$

$$16.4 = -3.4 + 0.2n$$

$$\frac{19.8}{0.2} = \frac{0.2n}{0.2}$$

$$99 = n$$

$$99 = n$$

$$S_{99} = \frac{99(-3.2 + 16.4)}{2}$$

$$S_{99} = 653.4$$

/3

23) Rationalize the denominator:

$$\frac{4\sqrt{2}}{\sqrt{3}-1} \cdot \frac{\sqrt{3}+1}{\sqrt{3}+1}$$

$$\frac{4\sqrt{6} + 4\sqrt{2}}{\sqrt{9}-1}$$

$$\frac{4\sqrt{6} + 4\sqrt{2}}{3-1}$$

$$= \frac{4\sqrt{6} + 4\sqrt{2}}{2}$$

$$= \frac{4\sqrt{6} + 4\sqrt{2}}{2}$$

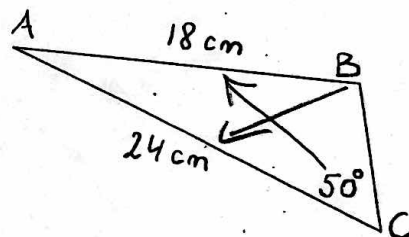
$$= 2\sqrt{6} + 2\sqrt{2}$$

$$= 2\sqrt{6} + 2\sqrt{2}$$

/3

26) Write the equa

24) Determine all angles in the shown triangle. Note that the angle B is obtuse. Round answers to the nearest degree (no decimals).



$$\frac{\sin 50}{18} = \frac{\sin B}{24}$$

$$\sin B = 1.021$$

(error on calculator)

No solutions for



(means no possible Δ can be drawn with these dimensions)

27) Complete the

$$\left(\frac{6}{2}\right)^2$$

Vertex: (+

25) Solve: $x - 4 = \sqrt{x + 2}$. Remember to check your answers and reject extraneous solutions if they exist.

$$(x-4)^2 = (\sqrt{x+2})^2 \quad x \geq -2$$

$$x^2 - 8x + 16 = x + 2$$

$$x^2 - 9x + 14 = 0$$

$$(x-7)(x-2) = 0$$

$$x = 7 \quad x = 2$$

$$7 - 4 = \sqrt{7+2} \quad 2 - 4 = \sqrt{2+2}$$

$$3 = \sqrt{9} \quad -2 = \sqrt{4}$$

$$\frac{9(-3, 2+16, 4)}{2}$$

53, 4

26) Write the equation of a parabola that has the vertex $(3, -2)$ and passes through the point $(5, 0)$.

$$y = a(x-p)^2 + q$$

$$y = a(x-3)^2 + -2$$

$$0 = a(5-3)^2 - 2$$

$$0 = a(4) - 2$$

$$0 = 4a - 2$$

$$2 = 4a$$

$$\frac{1}{2} = a$$

$$y = \frac{1}{2}(x-3)^2 - 2$$

27) Complete the square to change $y = 3x^2 - 18x + 2$ into the $y = a(x-p)^2 + q$ form.

$$y = 3(x^2 - 6x + 9) + 2 - 27$$

$$y = 3(x-3)^2 - 25$$

Vertex: $(+3, -25)$ Equation of the axis of symmetry: $x = 3$

/4

/12

Part B

Name: _____

Calculators are allowed.

Score:

/26

Short Response Questions (2 marks each)

Show work. Place answers in the box

1) Determine the nonpermissible value(s) of the variable in the expression: $\frac{(x+4)(x-5)}{x(x-5)(x+2)}$

Answer:

$x \neq 0, 5, -2$

/2

2) Reduce the expression $\frac{x^2-3x-10}{x^2-4}$ to lowest terms, provided that $x \neq \pm 2$

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

Answer:

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

/2

3) Simplify completely: $\frac{5}{2y} - \frac{3}{4y} + \frac{4}{y}$, provided that $y \neq 0$

$$\frac{10 - 3 + 16}{4y}$$

$$\frac{23}{4y}$$

Answer:

$$\frac{23}{4y}$$

/2

/6

4) Simplify $\frac{m^2-m-12}{m+3} \div \frac{3m-12}{m^2-9}$ and state the restrictions.

$$\frac{(m-4)\cancel{(m+3)}}{\cancel{(m+3)}} \div \frac{3(m-4)}{(m-3)(m+3)}$$

$$\frac{\cancel{m-4}}{1} \cdot \frac{(m-3)(m+3)}{3\cancel{(m-4)}}$$

Answer: $m \neq 3, -3, 4$
 $\frac{(m-3)(m+3)}{3}$ /2

5) What are the solutions of the equation $|x - 4| = 5$?

$$\begin{aligned} x-4 &= 5 \\ x &= 9 \end{aligned}$$

$$\begin{aligned} -(x-4) &= 5 \\ -x+4 &= 5 \\ -x &= 1 \\ x &= -1 \end{aligned}$$

Answer: $x = 9, -1$ /2

6) Solve the system of equations by substitution:

$y = 2x$
 $y = x^2 + 2x - 9$

$$\begin{aligned} 2x &= x^2 + 2x - 9 \\ 0 &= x^2 - 9 \\ 0 &= (x-3)(x+3) \\ x &= 3, -3 \end{aligned}$$

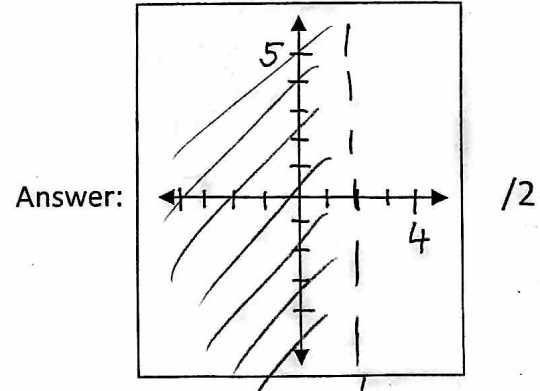
Answer: $(3, 6)$
 $(-3, -6)$ /2

7) Sketch and shade the part of the plane that represents the solution of the inequality $x - 2 < 0$

$$x < 2$$

$$x = 2$$

/8



Full Response Questions (marks are awarded for the clarity and accuracy of each step within solutions)

8) State the nonpermissible value(s) and solve algebraically.

$$\frac{4x+10}{x^2-1} = \frac{x}{x+1} + 2 \quad (x+1)(x-1)$$

$$x \neq 1, -1$$

$$CD = (x-1)(x+1)$$

$$4x+10 = x(x-1) + 2(x+1)(x-1)$$

$$4x+10 = x^2 - x + 2(x^2 - 1)$$

$$4x+10 = x^2 - x + 2x^2 - 2$$

$$0 = 3x^2 - 5x - 12$$

$$3x^2 - 9x + 4x - 12$$

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

$$x = -\frac{4}{3} \quad x = 3$$

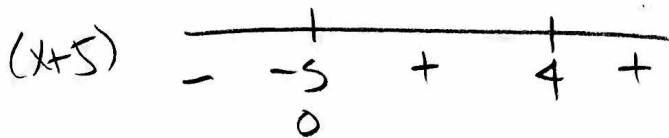
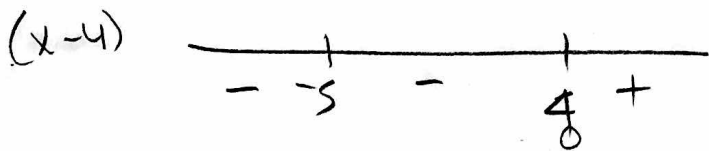
$\frac{36}{9}$

/4

9) Solve the inequality: $(x-4)(x+5) \geq 0$

one variable

roots 4, -5

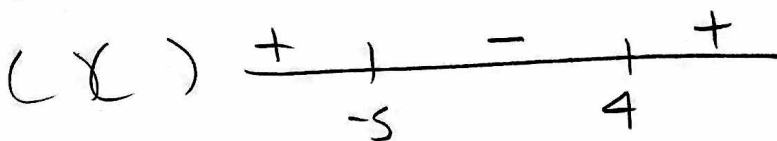


$$x \leq -5$$

and

$$x \geq 4$$

/4



/8

10) Diagrams below show the graph of the function $f(x) = -(x - 3)^2 + 1$

a) Graph the function $y = |f(x)|$ (1 mark)

absolute value

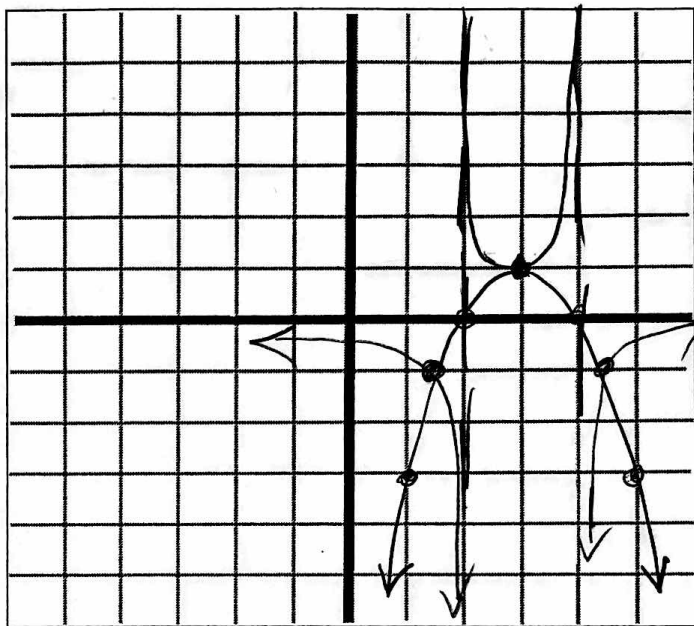
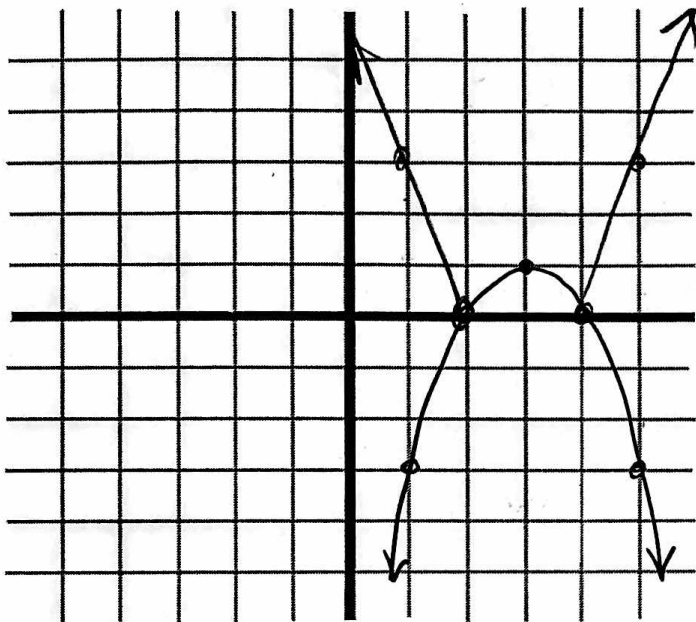
no negatives

b) Graph the function $y = \frac{1}{f(x)}$ (3 marks)

big \rightarrow small
small \rightarrow big

reciprocal

invariant points
 $x=1, -1$



/4

asymptotes

$$x=2$$

$$x=4$$

/4