Write the first 5 terms of the sequence

11. $a_n = \dfrac{n}{n+2}$
9.1

$a_1 = \frac{1}{1+2} = \frac{1}{3}$

$a_2 = \frac{2}{2+2} = \frac{2}{4} = \frac{1}{2}$

$a_3 = \frac{3}{3+2} = \frac{3}{5}$

$a_4 = \frac{4}{4+2} = \frac{4}{6} = \frac{2}{3}$

$a_5 = \frac{5}{5+2} = \frac{5}{7}$

$\frac{1}{3}, \frac{1}{2}, \frac{3}{5}, \frac{2}{3}, \frac{5}{7}$

7. $a_n = 4n - 7$
9.1

Find the sum.

67. $\sum_{i=1}^{5} (2i + 1)$
9.1

$(2\cdot1+1)+(2\cdot2+1)+(2\cdot3+1)+(2\cdot4+1)+(2\cdot5+1)$

$3+5+7+9+11 = 35$

$a_1 = 3 \quad a_5 = 11 \quad n = 5$

Arithmetic

$S_n = \frac{n}{2}(a_1 + a_n)$

$S_5 = \frac{5}{2}(3+11)$

$S_5 = 35$

73. $\sum_{i=1}^{4} 2^i$
9.1

Determine whether the sequence is arithmetic (or geometric). If it is arithmetic, then find the common difference d. If it is geometric, then find the common ratio r.

5. 10, 8, 6, 4, 2, . . .
9.2

arithmetic

$d: 8-10 = -2$

$d = -2$

7. 1, 2, 4, 8, 16, . . .
9.2

geometric

$r: \frac{2}{1} = 2$

$r = 2$

9. $\frac{9}{4}, 2, \frac{7}{4}, \frac{3}{2}, \frac{5}{4}, \ldots$
9.2

$\frac{9}{4}, \frac{8}{4}, \frac{7}{4}, \frac{6}{4}, \frac{5}{4}$

arithmetic

$d = \frac{8}{4} - \frac{9}{4} = -\frac{1}{4}$

5. 2, 10, 50, 250, . . .
9.3

7. $\frac{1}{8}, \frac{1}{4}, \frac{1}{2}, 1, \ldots$
9.3

Geometric

$r = \dfrac{\frac{1}{4}}{\frac{1}{8}} = \frac{1}{4} \cdot \frac{8}{1} = 2$

$r = 2$

Find a formula for a_n for the arithmetic sequence.

$a_n = a_1 + (n-1)d$

21. $a_1 = 1, d = 3$

25. $4, \frac{3}{2}, -1, -\frac{7}{2}, \ldots$

$a_1 = 4 \quad d: \frac{3}{2} - \frac{4}{1}\cdot\frac{2}{2}$

$d: -\frac{5}{2}$

$a_n = a_1 + (n-1)d$

$a_n = 4 + (n-1)\cdot -\frac{5}{2}$

$a_n = 4\frac{2}{2} - \frac{5}{2}n + \frac{5}{2}$

$a_n = -\frac{5}{2}n + \frac{13}{2}$

Write the first five terms of the ~~geometric sequence.~~

13. $a_1 = 4, r = 3$
9.3

$a_1 = 4$

$a_2 = 4\cdot3 = 12$

$a_3 = 12\cdot3 = 36$

$a_4 = 36\cdot3 = 108$

$a_5 = 108\cdot3 = 324$

4, 12, 36, 108, 324

15. $a_1 = 1, r = \frac{1}{2}$
9.3

Find the ~~sum of the finite geometric sequences~~

57. $\sum_{n=1}^{6} (-7)^{n-1}$
9.3

$S_n = a_1\left(\frac{1-r^n}{1-r}\right)$

$a_1 = (-7)^{1-1} = 1$

$a_2 = (-7)^{2-1} = -7$

$r = \frac{-7}{1} = -7$

$n = 6$

$S_6 = 1\left(\frac{1-(-7)^6}{1-(-7)}\right)$

$S_6 = 14{,}706$

Write the standard form of the following equation, and identify it as an ellipse or hyperbola.
Use the equation for the (ellipse or hyperbola) and find the following: center, vertices, foci, graph (include center, vertices, foci and if needed asymptotes).

29. $16x^2 + 9y^2 - 32x + 72y + 16 = 0$
10.3

$16x^2 - 32x + \_ + 9y^2 + 72y + \_ = -16 + \_ + \_$

$16(x^2 - 2x + 1) + 9(y^2 + 8y + 16) = -16 + 16(1) + 9(16)$

$\left(\frac{-2}{2}\right)^2$, $(-1)^2$, 1; $\left(\frac{8}{2}\right)^2$, $(4)^2 = 16$

$\frac{16(x-1)^2}{144} + \frac{9(y+4)^2}{144} = \frac{144}{144}$

$\frac{(x-1)^2}{9} + \frac{(y+4)^2}{16} = 1$ ellipse

$b^2 = 9$, $b = 3$

$a^2 = 16$, $a = 4$ maj axis vertical

$c^2 = a^2 - b^2$
$c^2 = 16 - 9$
$c^2 = 7$
$c = \pm\sqrt{7}$

$\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$

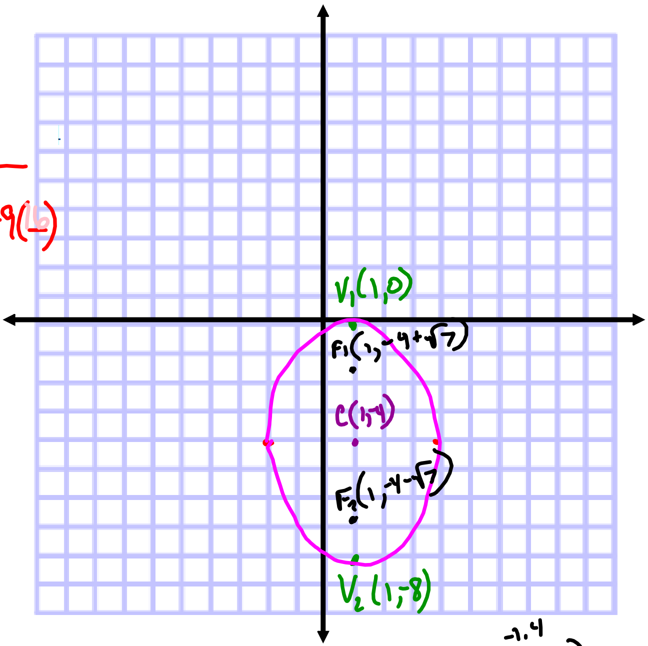
Center (h,k)
$(1,-4)$

vertices $(h, k \pm a)$
$(1, -4+4) : (1,0)$
$(1, -4-4) : (1,-8)$

minor axis pts
$(h \pm b, k)$
$(1 \pm 3, -4)$
$(4,-4)$ & $(-2,-4)$

foci
$(h, k \pm c)$
$(1, -4 \pm \sqrt{7})$

$(1, -4+\sqrt{7})$ -1.4
$(1, -4-\sqrt{7})$ -6.6



37. $9x^2 - 16y^2 - 18x - 32y - 151 = 0$
10.4

$9x^2 - 18x + \_ - 16y^2 - 32y + \_ = 151 + \_ + \_$

$9(x^2 - 2x + 1) - 16(y^2 + 2y + 1) = 151 + 9(1) - 16(1)$

$\left(\frac{-2x}{2}\right)$, $(-1)^2$, 1; $\left(\frac{2}{2}\right)^2 = 1^2 = 1$

$\frac{9(x-1)^2}{144} - \frac{16(y+1)^2}{144} = \frac{144}{144}$

$\frac{(x-1)^2}{16} - \frac{(y+1)^2}{9} = 1$

hyperbola
transverse axis is horizontal

$a^2 = 16$, $a = 4$

$b^2 = 9$, $b = 3$

$c^2 = a^2 + b^2$
$c^2 = 16 + 9$
$c^2 = 25$
$c = \pm 5$

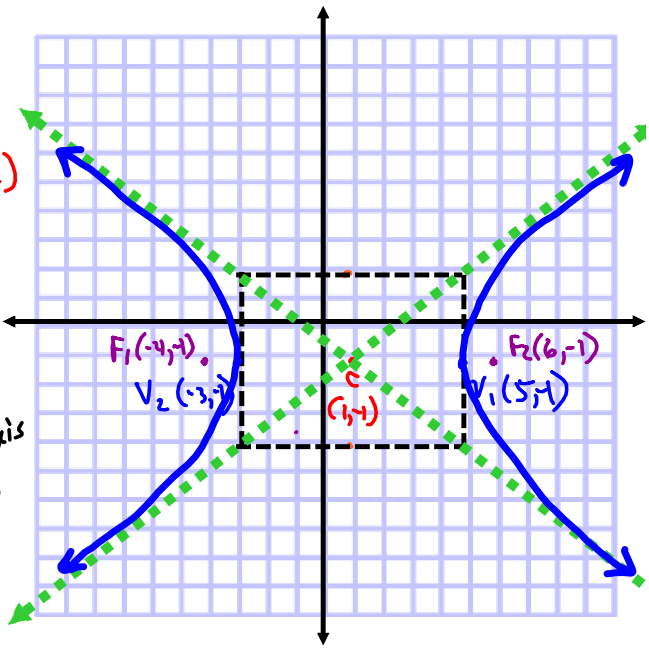
$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$

Center (h,k)
$(1,-1)$

vertices $(h \pm a, k)$
$(1 \pm 4, -1)$
$(5,-1)$ and $(-3,-1)$

conjugate axis points $(h, k \pm b)$
$(1, -1 \pm 3)$
$(1,-4)$ & $(1,2)$

Foci $(h \pm c, k)$
$(1 \pm 5, -1)$
$(-4,-1)$ and $(6,-1)$



Write the first 5 terms of the sequence

11. $a_n = \dfrac{n}{n+2}$
9.1

$a_1 = \frac{1}{1+2} = \frac{1}{3}$

$a_2 = \frac{2}{2+2} = \frac{2}{4} = \frac{1}{2}$

$a_3 = \frac{3}{3+2} = \frac{3}{5}$

$a_4 = \frac{4}{4+2} = \frac{4}{6} = \frac{2}{3}$

$a_5 = \frac{5}{5+2} = \frac{5}{7}$

$\frac{1}{3}, \frac{1}{2}, \frac{3}{5}, \frac{2}{3}, \frac{5}{7}$

7. $a_n = 4n - 7$
9.1

Find the sum.

67. $\sum_{i=1}^{5} (2i + 1)$
9.1

$(2\cdot1+1) + (2\cdot2+1) + (2\cdot3+1) + (2\cdot4+1) + (2\cdot5+1)$
$3 + 5 + 7 + 9 + 11$

$a_1 = 3 \quad a_5 = 11 \quad n = 5$ arithmetic

$S_n = \frac{n}{2}(a_1 + a_n)$

$S_5 = \frac{5}{2}(3 + 11)$

$\frac{5}{2} \cdot 14$

35

73. $\sum_{i=1}^{4} 2^i$
9.1

Determine whether the sequence is arithmetic (or geometric). If it is arithmetic, then find the common difference d. If it is geometric, then find the common ratio r.

5. 10, 8, 6, 4, 2, . . . arithmetic
9.2
$d = 8 - 10 = -2$

7. 1, 2, 4, 8, 16, . . . geometric
9.2
$r = 2$

9. $\frac{9}{4}, \frac{2}{1}, \frac{7}{4}, \frac{3}{2}, \frac{5}{4}, \ldots$ arith
9.2
$\frac{9}{4}, \frac{8}{4}, \frac{7}{4}, \frac{6}{4}, \frac{5}{4}$

$d = \frac{5}{4} - \frac{6}{4} = -\frac{1}{4}$

5. 2, 10, 50, 250, . . . geometric
9.3
$r = 5$

7. $\frac{1}{8}, \frac{1}{4}, \frac{1}{2}, \ldots$
9.3

$\frac{1}{4} \div \frac{1}{8} = \frac{1}{4} \cdot \frac{8}{1} = 2$

$r = 2$

GO

$a_n = a_1 + (n-1)d$

Find a formula for a_n for the ~~arithmetic~~ sequence.

21. $a_1 = 1, d = 3$

$a_n = a_1 + (n-1)d$

$a_n = 1 + (n-1)3$

$a_n = 1 + 3n - 3$

$a_n = -2 + 3n$

$a_n = 3n - 2$

25. $4, \frac{3}{2}, -1, -\frac{7}{2}, \ldots$

$a_1 = 4 \quad d = \frac{3}{2} - \frac{4}{1} \cdot \frac{2}{2}$

$\frac{3}{2} - \frac{8}{2}$

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

$a_n = 4 + (n-1)(-\frac{5}{2})$

$a_n = 4 \cdot \frac{2}{2} - \frac{5}{2}n + \frac{5}{2}$

$a_n = -\frac{5}{2}n + \frac{13}{2}$

$S_n = a_1\left(\frac{1-r^n}{1-r}\right)$

Write the first five terms of the ~~geometric~~ sequence.

13. $a_1 = 4, r = 3$
9.3

$a_1 = 4$

$a_2 = 4 \cdot 3 = 12$

$a_3 = 12 \cdot 3 = 36$

$a_4 = 36 \cdot 3 = 108$

$a_5 = 108 \cdot 3 = 324$

4, 12, 36, 108, 324

15. $a_1 = 1, r = \frac{1}{2}$
9.3

Find the sum of the finite geometric sequencs

57. $\sum_{n=1}^{6} (-7)^{n-1}$
9.3

$n=1 \quad (-7)^{1-1} = (-7)^0 = 1 \quad a_1 = 1$

$n=2 \quad (-7)^{2-1} = (-7)^1 = -7 \quad r = \frac{-7}{1} = -7$

$S_n = 1\left(\frac{1-(-7)^6}{1-(-7)}\right)$

$S_6 = \frac{1-117649}{8} = \frac{-117648}{8}$

$= -14706$

Write the standard form of the following equation, and identify it as an ellipse or hyperbola.
Use the equation for the (ellipse or hyperbola) and find the following: center, vertices, foci, graph (include center, vertices, foci and if needed asymptotes).

29. $16x^2 + 9y^2 - 32x + 72y + 16 = 0$
10.3

$16x^2 - 32x + \_\_ + 9y^2 + 72y + \_\_ = -16 + \_\_ + \_\_$

$16(x^2 - 2x + 1) + 9(y^2 + 8y + 16) = -16 + 16(1) + 9(16)$

$\frac{16(x-1)^2}{144} + \frac{9(y+4)^2}{144} = \frac{144}{144}$

Given: $\frac{(x-1)^2}{9} + \frac{(y+4)^2}{16} = 1$

ellipse ans

center $(1,-4)$

$a = \sqrt{16} = 4$

$b = \sqrt{9} = b = 3$

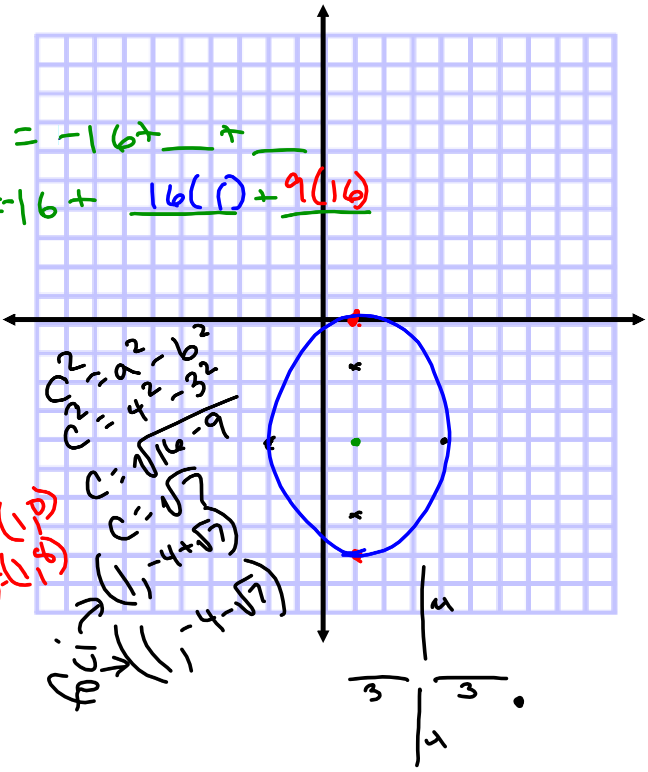
$(1, -4+4) = (1, 0)$
$(1, -4-4) = (1, -8)$

$(1+3, -4)$
$(1-3, -4)$

$(4,-4)$
$(-2,-4)$

$c^2 = a^2 - b^2$
$c^2 = 4^2 - 3^2$
$c = \sqrt{16-9}$
$c = \sqrt{7}$

$(1, -4+\sqrt{7})$
$(1, -4-\sqrt{7})$



37. $9x^2 - 16y^2 - 18x - 32y - 151 = 0$
10.4

$9x^2 - 18x - 16y^2 - 32y = 151$

$9(x^2 - 2x + 1) - 16(y^2 + 2y + 1) = 151 + 9(1) - 16(1)$

$\frac{9(x-1)^2}{144} - \frac{16(y+1)^2}{144} = \frac{144}{144}$

$\frac{(x-1)^2}{16} - \frac{(y+1)^2}{9} = 1$ graph

pos transverse axis horiz

$a = 4$ under positive

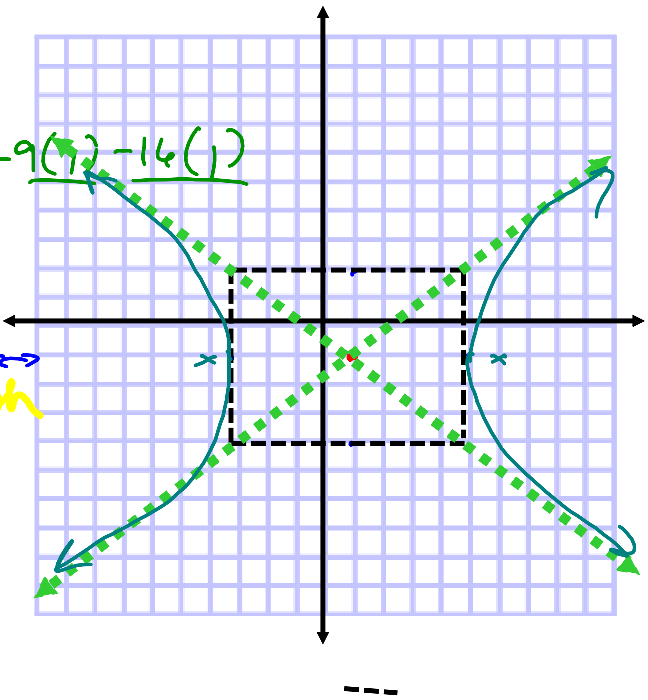
$b = 3$

$\boxed{\text{center } (1,-1)}$

$(5,-1)$
$(-3,-1)$

$c^2 = a^2 + b^2$
$c = \sqrt{4^2 + 3^2}$
$c = 5$

$(1,2)$
$(1,-4)$



Write the first 5 terms of the sequence

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$a_2 = \frac{2}{2+2} = \frac{1}{2}$

$a_3 = \frac{3}{3+2} = \frac{3}{5}$

$a_4 = \frac{4}{4+2} = \frac{2}{3}$

$a_5 = \frac{5}{5+2} = \frac{5}{7}$

7. $a_n = 4n - 7$
9.1

$a_1 = 4(1) - 7 = -3$

$a_2 = 4(2) - 7 = 1$

$a_3 = 4(3) - 7 = 5$

$a_4 = 4(4) - 7 = 9$

$a_5 = 4(5) - 7 = 13$

Find the sum.

67. $\sum_{i=1}^{5} (2i + 1)$
9.1

$= (2+1) + (4+1) + (6+1) +$
$+ (8+1) + (10+1) = 35$

73. $\sum_{i=1}^{4} 2^i = 2^1 + 2^2 + 2^3 + 2^4 = 30$
9.1

Determine whether the sequence is arithmetic (or geometric). If it is arithmetic, then find the common difference d. If it is geometric, then find the common ratio r.

5. $10, 8, 6, 4, 2, \ldots$
9.2

Arithmetic sequence, $d = -2$

7. $1, 2, 4, 8, 16, \ldots$
9.2

~~Not an arithmetic sequence~~
(from 9.3 this is Geometric and r=2)

9. $\frac{9}{4}, 2, \frac{7}{4}, \frac{3}{2}, \frac{5}{4}, \ldots$
9.2

Arithmetic sequence, $d = -\frac{1}{4}$

5. $2, 10, 50, 250, \ldots$
9.3 Geometric sequence, $r = 5$

7. $\frac{1}{8}, \frac{1}{4}, \frac{1}{2}, 1, \ldots$
9.3

Geometric sequence, $r = 2$

Find a formula for a_n for the arithmetic sequence.

21. $a_1 = 1, d = 3$

$a_n = a_1 + (n-1)d$

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

$= 3n - 2$

25. $4, \frac{3}{2}, -1, -\frac{7}{2}, \ldots$

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

$a_n = a_1 + (n-1)d$

$= 4 + (n-1)\left(-\frac{5}{2}\right)$

$= -\frac{5}{2}n + \frac{13}{2}$

Write the first five terms of the geometric sequence.

13. $a_1 = 4, r = 3$
9.3

$a_1 = 4$

$a_2 = 4(3) = 12$

$a_3 = 12(3) = 36$

$a_4 = 36(3) = 108$

$a_5 = 108(3) = 324$

15. $a_1 = 1, r = \frac{1}{2}$
9.3

$a_1 = 1$

$a_2 = 1\left(\frac{1}{2}\right) = \frac{1}{2}$

$a_3 = \frac{1}{2}\left(\frac{1}{2}\right) = \frac{1}{4}$

$a_4 = \frac{1}{4}\left(\frac{1}{2}\right) = \frac{1}{8}$

$a_5 = \frac{1}{8}\left(\frac{1}{2}\right) = \frac{1}{16}$

Find the sum of the finite geometric sequencs

57. $\sum_{n=1}^{6} (-7)^{n-1}$
9.3

$= 1 + (-7) + (-7)^2 + \cdots + (-7)^5$

$\Rightarrow a_1 = 1, r = -7$

$$S_6 = \frac{1\left(1 - (-7)^6\right)}{1 - (-7)} = -14{,}706$$