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2 In an arithmetic sequence, $u_6 = -5$ and $u_9 = -20$. Find S_{20}.

$u_n = d(n-1) + u_1$

$-5 = d(6-1) + u_1 \rightarrow (u_1 + 5d = -5) \rightarrow -\cancel{u_1} - 5d = 5$

And

$-20 = d(9-1) + u_1$ $\quad u_1 + 8d = -20 \quad +(\cancel{u_1} + 8d = -20)$

$3d = -15$

$d = -5$

$-5 = 5(-5) + u_1$

$20 = u_1$

$S_{20} = \frac{20}{2}[-5(20-1) + 40]$

$S_{20} = -550$

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4 For the geometric series $0.5 - 0.1 + 0.02 \ldots$ $S_n = 0.416$. Find the number of terms in the series.

1	2	3	4	5
0.5	-0.1	0.02	-0.004	0.0008
0.5	0.4	0.42	0.416	

S_n

$\boxed{n=4}$

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7 How many terms are in the sequence 4, 7, 10, …, 61?

+3

$d=3 \quad u_1 = 4 \quad u_n = 61$

$61 = 3(n-1) + 4$

$57 = 3(n-1)$

$19 = n-1$

$\boxed{n=20}$

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8 In a geometric sequence, the fourth term is 8 times the first term. If the sum of the first 8 terms is 765, find the 9th term of the sequence.

$u_4 = 8u_1 \quad S_8 = 765$

① $u_n = u_1 \cdot r^{n-1}$

$u_4 = u_1 \cdot r^3$

$8\cancel{u_1} = \cancel{u_1} \cdot r^3$

$8 = r^3$

$2 = r$

② $S_n = \dfrac{u_1(r^n - 1)}{r-1}$

$765 = \dfrac{u_1(2^8 - 1)}{2-1}$

$765 = 255u_1$

$u_1 = 3$

③ $u_9 = 3 \cdot 2^8$

$\boxed{u_9 = 768}$

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9 Three consecutive terms of a geometric sequence are $x - 3$, 6 and $x + 2$. Find all possible values of x.

$r = \dfrac{6}{x-3}$ And $r = \dfrac{x+2}{6}$

$\dfrac{6}{x-3} = \dfrac{x+2}{6}$

$(x-3)(x+2) = 36$

$x^2 - 1x - 6 = 36$

$x^2 - 1x - 42 = 0$

$(x-7)(x+6) = 0$

$\boxed{x = 7}$ or $\boxed{x = -6}$

---

14 Using the binomial theorem, expand $(3x - y)^6$.

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
$\boxed{1 \quad 6 \quad 15 \quad 20 \quad 15 \quad 6 \quad 1}$ $n=6$

$1(3x)^6(-y)^0 + 6(3x)^5(-y)^1 + 15(3x)^4(-y)^2 + 20(3x)^3(-y)^3$

$+ 15(3x)^2(-y)^4 + 6(3x)^1(-y)^5 + 1(3x)^0(-y)^6$

$$\boxed{729x^6 - 1458x^5y + 1215x^4y^2 - 540x^3y^3 + 135x^2y^4 - 18xy^5 + y^6}$$

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22 P1: The 15th term of an arithmetic series is 143 and the 31st term is 183.

a Find the first term and the common difference.

b Find the 100th term of the series.

(a)

$143 = d(15-1) + u_1$

$183 = d(31-1) + u_1$

$30d + \cancel{u_1} = 183$

$-(14d + \cancel{u_1} = 143)$

$16d = 40 \rightarrow d = 2.5$

And

$u_1 = -14(2.5) + 143$

$u_1 = 108$

(b)

$u_{100} = 2.5(100-1) + 108$

$\boxed{u_{100} = 355.5}$

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26 P1: The coefficient of x^2 in the binomial expansion of $(1+3x)^n$ is 495.

Determine the value of n.

$\binom{n}{r} a^{n-r} b^r \quad (r=2)$

$\binom{n}{2} (1)^{n-2} (3x)^2$

$\frac{n!}{2!(n-2)!}[9x^2]$

$\frac{495}{9} = 55$

$\frac{n!}{2!(n-2)!} = 55$

$\frac{n(n-1)\cancel{(n-2)!}}{2\cancel{(n-2)!}} = \frac{55}{1}$

$n^2 - n = 110 \rightarrow n^2 - n - 110 = 0 \rightarrow (n-11)(n+10) = 0 \rightarrow \boxed{n = 11}$ $\cancel{n = -10}$

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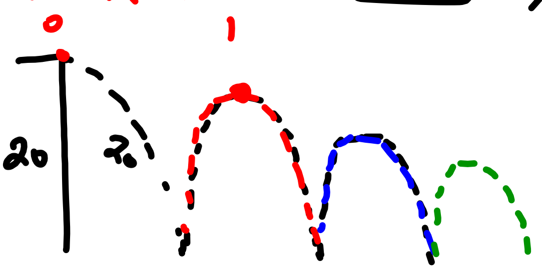
32 P1: A ball is dropped from a vertical height of 20 m.

Following each bounce, it rebounds to a vertical height of $\frac{5}{6}$ its previous height.

Assuming that the ball continues to bounce indefinitely, show that the maximum distance it can travel is 220 m.



$20 + 2\left(\frac{5}{6}\right)(20) + 2\left(\frac{5}{6}\right)\left(\frac{5}{6}\right)(20) + 2\left(\frac{5}{6}\right)\left(\frac{5}{6}\right)\left(\frac{5}{6}\right)(20) + \cdots$

0 1 2 3

$u_1 = 2\left(\frac{5}{6}\right)(20)$

$u_1 = \frac{200}{6} = \frac{100}{3}$

$S_\infty = \frac{\frac{100}{3}}{1-\frac{5}{6}} = \left(\frac{100}{3}\right)\left(\frac{6}{1}\right) = \frac{600}{3} = 200$

Total $= 20 + 200 = \boxed{220}$

(initial Height)