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Klasse

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| Station  „Figurierte Zahlen“  Teil 3  Arbeitsheft | |  | | --- | |  | | Tischnummer | |

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Liebe Schülerinnen und Schüler!

Schon die alten Griechen haben Zahlen mit Hilfe von Zählsteinen dargestellt. Die Steinchen wurden zu unterschiedlichen Figuren zusammengelegt. Dadurch haben die Griechen wichtige Eigenschaften von Zahlen untersuchen und aufzeigen können. Auch noch viele Jahrhunderte später wurden mit Hilfe von Figuren und regelmäßigen Mustern mathematische Aussagen bewiesen.

Wichtig: Bearbeitet bitte alle Aufgaben der Reihe nach!



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|  | Zu dieser Aufgabe gibt es Hilfen im Hilfeheft. |
|  | Diskutiert hier eure wichtigsten Ergebnisse und fasst sie zusammen. |
|  | Zu dieser Aufgabe gibt es eine Simulation oder ein Video. |
|  | Zu dieser Aufgabe gibt es Material auf eurem Tisch. |

Wir wünschen Euch viel Spaß beim Experimentieren und Entdecken!

Das Mathematik-Labor-Team

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| Im Supermarkt kann man manchmal sehen, wie Obst pyramidenförmig gestapelt wird. Solche Anordnungen wählt man, weil sie platzsparend und stabil sind.  Außerdem sehen sie schön aus. |  |

Einige figurierte Zahlen kann man auch

als räumliche Figur darstellen. Dazu wählt

man als Grundlage eine dreieckige Ausgangsform und nicht eine rechteckige oder quadratische (wie in dem Foto).

Für die folgenden Aufgaben steht euch dieses Material zur Verfügung:

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| Material   * Legebretter (auf   beiden Seiten  benutzbar)   * Holzkugeln in 2   Farben   * 2 Holzpinzetten   (zum Greifen der  Holzkugeln) |  |



3.1 Baut auf dem Legebrett (Seite A) die ersten vier Pyramiden mit dreieckiger Grundseite. Verwendet für die Schichten abwechselnd andere Farben. **Denkt daran, dass die erste Pyramide nur aus 1 Kugel besteht.**

3.2 Vervollständigt die Tabelle mit den ersten sieben Tetraederzahlen.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bezeichnung | T1 | T2 | T3 | T4 | T5 | T6 | T7 |  |
| Anzahlt der  Schichten | 1 |  |  |  |  |  |  |  | |
| Anzahl der  Kugeln | 1 |  |  |  |  |  |  |  |
| Veränderung | **+ 3** | | | | | | | |

3.3 Die Figuren, die ihr auf dem Legebrett ausgelegt habt nennt man **Tetraederzahlen**. Die erste Tetraederzahl wird mit T1 bezeichnet, die zweite mit T2 usw.

Um welche Tetraederzahl es sich dabei genau handelt, hängt davon ab, aus wie vielen Schichten und Kugeln das Gebilde besteht.

Die erste Tetraederzahl T1 besteht aus 1 Schicht und 1 Kugel.

Man schreibt: T1 = 1

Die zweite Tetraederzahl T2 besteht aus 2 Schichten und 4 Kugeln.

Man schreibt: T2 = 4

Die dritte Tetraederzahl \_\_\_ besteht aus \_\_\_ Schichten und \_\_\_ Kugeln.

Man schreibt: \_\_\_\_\_\_\_\_

Die siebte Tetraederzahl \_\_\_ besteht aus \_\_\_ Schichten und \_\_\_ Kugeln.

Man schreibt: \_\_\_\_\_\_\_\_



Schaut euch die **Simulation 9** an und verbessert notfalls den Lückentext.

3.4 Schaut euch die von euch gebauten Tetraederzahlen an. Welchen Zusammenhang erkennt ihr zwischen Tetraederzahlen und euch schon bekannten figurierten Zahlen?

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Diskutiert eure Überlegungen in der Gruppe.

3.5 Notiert eure Überlegungen nun mit der Verwendung der Fachsprache.

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3.6 Füllt die Lücken mit Hilfe eurer Überlegungen aus der vorherigen Aufgabe aus.

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| T1 = D1  T2 =\_\_\_\_+\_\_\_\_  T3 =  T4 =  T10 = |

3.7 Berechnet die Anzahl der Kugel von Tetraederzahl T10.

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|  |  |  | T10 = |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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Neben der Berechnung mit Hilfe der Dreieckszahlen gibt es noch eine Formel:

Tn = · n · (n+1) · (n+2)

3.8 Berechnet die Tetraederzahl T10 mit Hilfe der Formel.

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|  |  |  | T10 = |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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3.9 Vergleicht das Ergebnis aus der vorherigen Aufgabe mit euren Ergebnissen aus der Aufgabe 3.7. Welche Variante ist besser geeignet zur Berechnung von größeren Zahlen?

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3.10 Notiert den Term für Tn+Dn+1.

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|  |  |  |  | Tn + Dn+1 = |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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3.11 Notiert den Term für Tn+1.

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|  |  |  | Tn+1 = |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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3.12 Setzt in beide Terme (aus Aufgaben 3.10 und 3.11) für die Variable n die Zahl 5 ein. Was stellt ihr fest?

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Wie ihr in der Aufgabe zuvor festgestellt habt sind die Terme Tn + Dn+1 und Tn+1 für

n=5 gleich. Nun wollen wir dies verallgemeinern.

3.13 Stelle den Term Tn+Dn+1 auf und vereinfache.

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|  |  |  |  | Tn + Dn+1 = |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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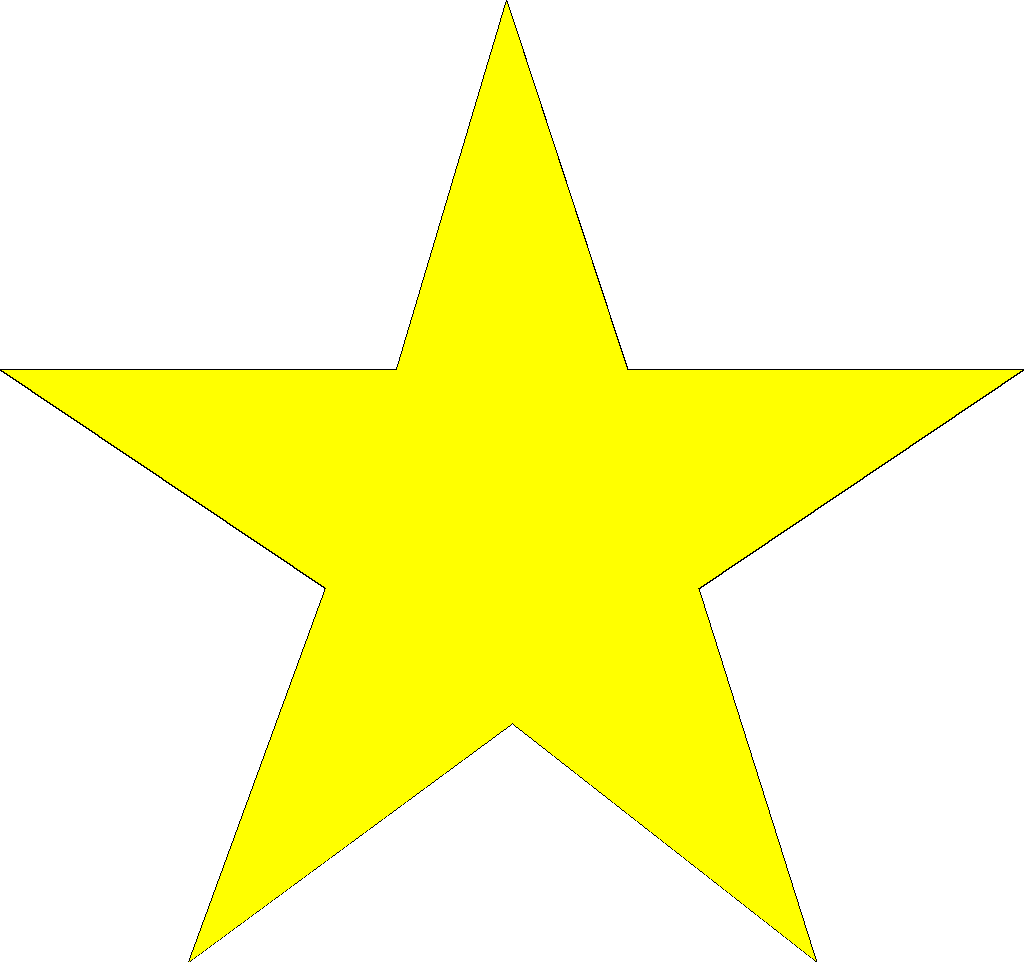
3.14 Stelle den Term Tn+1 auf und vereinfache.

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3.15 Was versteht man unter einem äquivalenten Term? Sind Tn+Dn+1 und Tn+1 äquivalent?

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3.16 Füllt nun das „Handout“ aus. Dieses liegt auf euren Tischen aus

 Zusatzaufgabe

3.17 Denkt euch mit Hilfe der Handouts in alle drei Teile dieser Station hinein.

Diskutiert in der Gruppe welcher Zusammenhang zwischen den einzelnen Teilen besteht.

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Bisher habt ihr Terme zu vorgegebenen geometrischen Figuren aufgestellt. Nun wollen wir zu vorgegebenen Termen dazugehörige Figuren finden.

Stellt euch vor, eine figurierte Zahl , dessen geometrische Darstellung ihr noch nicht kennt, kann folgendermaßen beschrieben werden:

Tn = · n · (n+1) · (n+2)

3.18 Wie könnte die dazugehörige geometrische Figur aussehen?

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Zusammengestellt von:

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| Kirstin Achatz, Theresa Exle, Anna Lurye |

Betreut von:

Rolf Oechsler

Variante B

Veröffentlicht am:

11.07.2017