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Basic proportionality theorem class 10 pdf

As a result of the European Union's General Data Protection Regulation (GDPR). We do not allow internet traffic to Byju websites from countries in the EU at this time. Tracking or performance measurement cookies are not served with this page. × Sorry!, this page is not currently available for bookmarks. Last updated on August 13, 2018 by Teachoo Subscribe to our Youtube Channel - Theorem 6.1 Transcript: If the drawn line is parallel to one side of the triangle to intersect the other two sides in different points, the other two sides are divided in the same ratio. Remember: Δ ABC place DE ∥ BC Proves: AD/DB = Construction AE/EC: Join BE and CD Draw DM ⊥ AC and EN ⊥ AB. Proof: Now, Now, ar (ADE) = 1/2 × High × Basic = 1/2 × AE × DM ar (DEC) = 1/2 × High × Basic = 1/2 × EC × DM Divide (3) and (4) ar (ADE) /ar (DEC) = (1/2 × AE × DM)/(1/2 × EC × DM) ar (ADE) /ar (DEC) = AE /EC Now, ΔBDE and ΔDEC are on the same DE base and between the same parallel lines SM and DE. ∴ ar (BDE) = ar (DEC) Therefore, ar (ADE) /ar (BDE) = ar (ADE) /ar (DEC) AD /DB = AE /EC Then Proven. A well-known Greek mathematician Thales gives an important truth relating to two equi-angular triangles, that is, the ratio of two corresponding sides in two equiangular triangles is always the same. Thales uses a result called Theorem Proportionality Basis for the same thing. Before discussing the criteria for other danorems of similar triangles, it is important to understand this very basicorem associated with triangles: Theorem Of Basic Proportionality or BPTOrema. This theorem is the key to understanding the concept of better similarity. Basic Proportionality Theorem: Theorem Of Basic Proportionality states that If the drawn line is parallel to one side of the triangle to intersect the other two sides in different points, the other two sides are divided in equal ratio. In the following image, the \(DE\) segment aligns with the \(BC\) side of \(\Delta ABC\). Notice how \(DE\) divides \(AB\) and \(AC\) in equal ratios: Proof of Basic Proportionality Theorems: Given: \(\Delta ABC\) \(DE\parallel BC\) To prove: \(\frac{{AD}}{{{{{DB}} = \frac{{AE}}{{EC}}\) Construction: Join \(BE\) and \(CD\) Image \(DP \bot AC\) Image \(EQ \bot AB\) Proof: Consider \(\Delta AED\). If you have to calculate this triangular area, you can take \(AD\) to base, and \(EQ\) to height, so: \[{\rm{ar}}\left({\Delta AED} \right) = \frac{1}{2} \times AD \times EQ\] Now, consider \(\Delta DEB\). To calculate this area of the triangle, you can take \(DB\) to base, and \(EQ\) (again) to height (perpendicular to the opposite vertex \(E\)). Thus, \[{\rm{ar}}\left({\Delta DEB} \right) = \frac{1}{2} \times DB \times EQ\] Next, consider the ratio of these two areas you have calculated: \[\frac{{{{\rm{ar}}\left({\Delta AED} {\Delta DEB} \right)}} = \frac{{\frac{1}{2} \times AD \times EQ}}{{\frac{1}{2} \times DB DB EQ}} = \frac{{AD}}{{DB}}\] In a completely analogue way, you can evaluate the area ratios \(\Delta AED\) and \(\Delta EDC\): \[\frac{\rm{ar}}\left({\Delta AED} \right)}}{{{{{\rm{ar}}\left({\Delta EDC} \right)}} = \frac{{\frac{1}{2} \times AE \times DP}}{{\frac{1}{2} \times EC \times DP}} = \frac{{{AE}}{{EC}}\] Finally, We know that two triangles are at the same base and between the same parallels in the area. Here, \(\Delta DEB\) and \(\Delta EDC\) are on the same base \(DE\) and between the same parallel - \(DE\parallel BC\) . \[\Rightarrow ar\left({\Delta DEB} \right) = ar\left({\Delta EDC} \right)\] Given the above results, we can note, \[{\frac{{ar\left({\Delta AED} \right)}}{{ar\left({\Delta DEB} \right)}} = \frac{{ar\left({\Delta AED} \right)}{{ar\left({\Delta EDC} \right)}}}}\[{ \Rightarrow \boxed{\frac{{AD}}{{DB}} = \frac{{AE}}{{EC}}}\] This completes our evidence of the fact that \(DE\) divides \(AB\) and \(AC\) in the same ratio. Therefore Proven. ✍Note: \(DE\) inline with \(BC\) is very important for proofing. Without this, the \(\Delta DEB\) and \(\Delta EDC\) areas would not be the same, and therefore the two ratios would be different. Can we say that the conversion of the Theorem Proportionality Base (CPM) will continue to apply? That is, in a triangle, the segment of the line divides the two sides in the same ratio, will it align with the third side? The answer is yes. Let's prove this. On the contrary CPM CPM states that In a triangle, if the segment of the line intersects two sides and divides it in the same ratio, it will be aligned with a third party. Reverse evidence of CPM: Consider the following image, Given that \({\frac{{AD}}{{DB}} = \frac{{AE}}{{EC}}}\) . Now, suppose \(DE\) is not aligned with \(BC\) . The segment image \(DF\) via \(D\) that is inline with \(BC\), as shown: Using CPM, we see that \(DF\) must divide \(AB\) and \(AC\) in the same ratio. Thus, we must have: \[\frac{{AD}}{{DB}} = \frac{{AF}}{{FC}}\] But it has been given to us that: \[\frac{{AD}}{{DB}} = \frac{{AE}}{{EC}}\] This means that: \[\frac{{AE}}{{EC}} = \frac{AF}}{{FC}}\] Adds 1 to both sides, we have, \[\begin{align} \frac{{AE}}{{EC}} + 1 &= \frac{{AF}}{{FC}} + 1 \hfill \\ \Rightarrow \frac{{{AE + EC}}{{EC}} &= \frac{{AF + FC}}{{FC}} \hfill \\ \Rightarrow \frac{{AC}}{{EC}} &= \frac{{AC}}{{FC}} \hfill \\ \end{align} \] \[\Rightarrow \boxed{EC = FC}\] This cannot be occurs if \(E\) and \(F\) are different points, so they must coincide. Thus, we can conclude that \(DE\) is parallel to \(BC\), hence completing the opposite evidence of CPM. Therefore Proven. Example solved Example 1: Consider \(\Delta ABC\), in which segments \(DE\) align with \(BC\) taken from \(D\) on \(AB\) to \(E\) in \(AC\), as shown below: Show \(\Delta ADE\) similar to \(\Delta ABC\). Solution: Remember that the two triangles are said to be similar if equi-angular (the corresponding angle is the same), and proportional side. It is clear that \(\Delta ADE\) and \(\Delta ABC\) are equi-angular, because: \(\angle A\) = \(\angle A\) (common angle) \(\angle ADE\) = \(\angle ABC\) (corresponding angle) \(\angle AED\) = \(\angle ACB\) (corresponding angle) Now, we will show that the corresponding side is proportional. Using CPM, we have: \[\begin{align}\frac{{AD}}{{DB}} &= \frac{{AE}}{{EC}}\\ \Rightarrow \quad \frac{{DB}}{{AD}} &= \= \frac{{EC}}{{AE}}\\ \Rightarrow \quad \frac{{DB}}{{{AD}} + 1 &= \frac{{EC}}{{AE}} + 1\\ \Rightarrow \Rightarrow \Rightarrow \quad \frac{{DB + AD}}{{AD}} &= \frac{{EC + AE}}{{AE}}\\ \Rightarrow \quad \frac{{AB}}{{AD}} &= \frac Thus we have shown two pairs of sides to be proportional. All that remains to be indicated is that the ratio above is also equal to the ratio of the third pair, that is, to \(\frac{{DE}}{{BC}}\). To prove that, segment image \(EF\) inline with \(AB\), as shown: Since \(EF\parallel AB\), CPM tells us that: \[\begin{align}\frac{{CE}}{{EA}} &= \frac {{CF}}{{FB}}\\ \Rightarrow \quad \frac{{CE}}{{EA}} + 1 &= \frac{{CF}}{{FB}} + 1\\ \EA}} + 1 &= \frac{{CF}}{{FB}} + 1\\ \\ \Rightarrow \quad \frac{{CE + EA}}{{EA}} &= \frac{CF + FB}}{{FB}}\\ \Rightarrow \Rightarrow \quad \frac{{AC}}{{AE}} &= \frac{{BC}}{{FB}}\end{align}\] But \(BF\) equals \(DE\) (because \(DEFB\) is a parallelogram) , and so on: \[\begin{align}\frac{{AC}}{{{AE}} &= \frac{{BC}}{{DE}}\\ \Rightarrow \quad \frac{{AE}}{{{AC}} &= \frac{{DE}}{{BC}}\end{align}\] Thus, we finally have: \[\frac{{AD}}{{DB}} = \frac{{AE}}{{AC}} = \frac{{DE}}{{BC}}\] This proves that the three sides are proportional, which means that the two triangles are similar. \[\Rightarrow \boxed{\Delta ADE \sim \Delta ABC}\] ✍Note: The results we have discussed here are very important and will often be used , so it is very important for you to go through the discussion again if you have not followed it completely. Challenges: \(E\) and \(F\) are points on the sides of \(PQ\) and \(PR\) respectively from \(\Delta PQR\). For the following cases, state whether \(EF\parallel QR\) , \(PQ = 1.28{\text{ cm}}\), \(PR = 2.56{\text{ cm}}\), \(PE = 0.18{\text{ cm}}\) and \(PF = 0.36{\text{ cm}}\) ⚡Tip: Apply converse of BPT. Example 2: \(ABCD\) is a trapezoid in such a way that \(AB\parallel DC\) . \(E\) and \(F\) are dots on the non-parallel sides of \(AD\) and \(BC\) respectively in such a way that \(EF\parallel AB\), as shown below: Show that \(\frac{{AE}}{{ED}} = \frac{{BF}}{{FC}}\) . Solution: Join \(BD\), and leave the \(EF\) intersection in \(G\), as shown below: Now, we will apply the CPM twice, once in \(\Delta ADB\), and once in \(\Delta DBC\). We have: \[\left\{ = \frac{{BG}}{{GD}}\\frac{{BG}}{{GD}} = \frac{{BF}}{{FC}}\end{align} \right.\] Clearly, \[\boxed{\frac{{AE}}{{ED}} = \frac{{BF}}{{FC}}}\] Challenge: \(ABCD\) is a trapezoid where \(AB\parallel DC\) and its diagonals intersect at the \(O\) point. Show that \(\frac{{AO}}{{BO}} = = . ⚡Tip: Image \(EO\) in such a way that \(E\) is the dot on \(AD\) and \(EO\parallel AB\) , then apply the CPM in \(\Delta DAB\) and \(\Delta ADC\). Example 3: Consider the following image: Given that \(\frac{{CD}}{{DA}} = \frac{{CE}}{{EB}}\), and \(\angle CDE\) = \(\angle CBA\). Prove that \(\Delta CAB\) is isosceles. Solution: We were given that \(\frac{{CD}}{{DA}} = \frac{{CE}}{{EB}}\) So with the conversion of CPM, we can note, \[DE\parallel AB\] Thus, \[\angle CDE = \angle CAB{\text{ }}\left({{\text{appropriate angle}}} \right)\] But it is also given that, \[\angle CDE = \angle CBA\] Which means that, \\angle CAB = \angle CBA\] \[\Rightarrow \boxed{CA = CB}\] Therefore \(\Delta CAB\) is isosceles. Challenge: Using the Basic Proportionality Theorem, prove that the line drawn through the midpoint of one side of the triangle parallel to the other spends the third side. ⚡Tip: Because the line is drawn through the center point, so dividing the sides of the triangle in equal proportions danorems is also known as the midpointorema. Theorem.

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